ELECTRONICS Australia

HIFI NEWS

NOVEMBER, 1975
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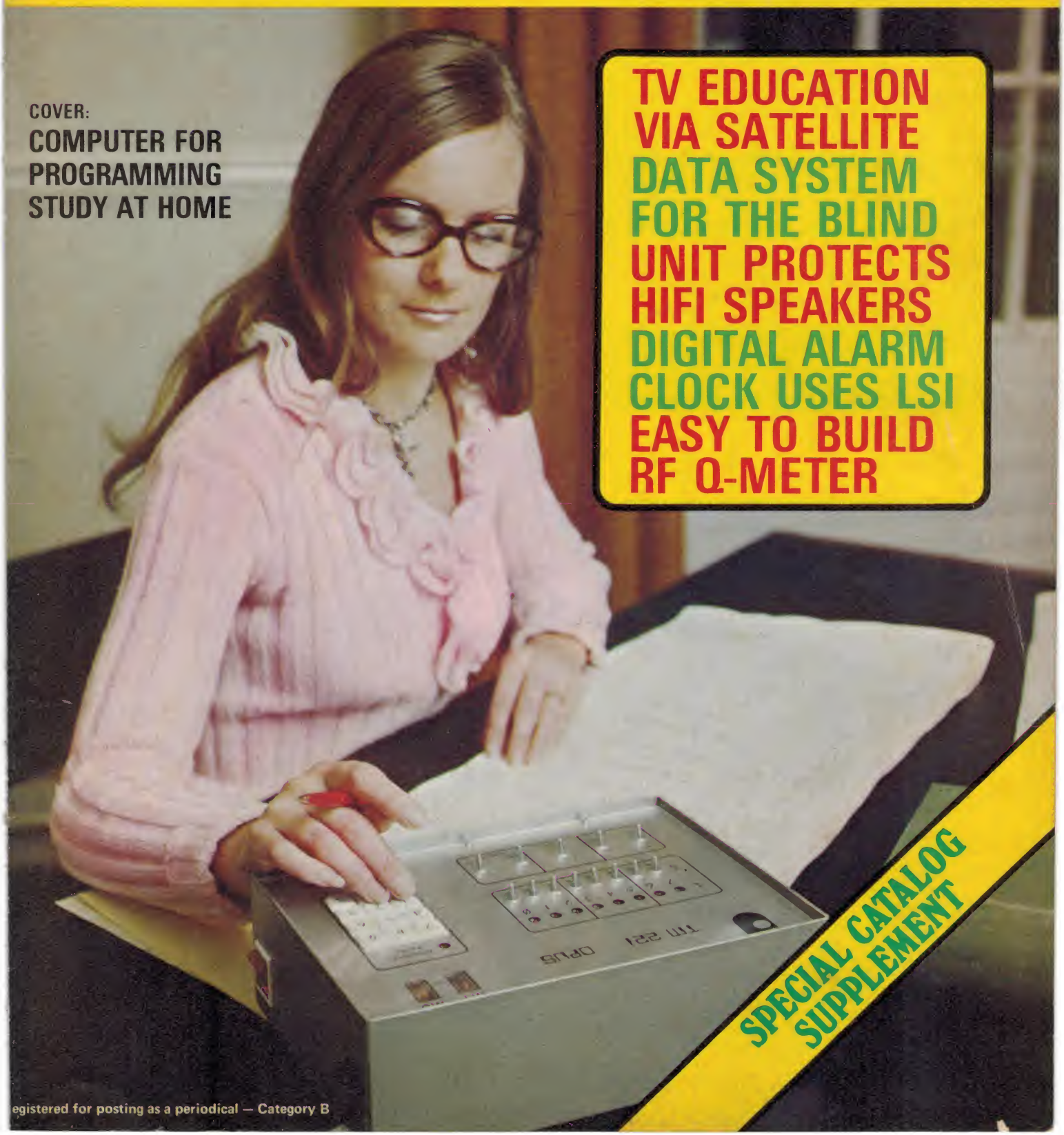

COVER:
COMPUTER FOR PROGRAMMING STUDY AT HOME

TV EDUCATION VIA SATELLITE

DATA SYSTEM FOR THE BLIND

UNIT PROTECTS HIFI SPEAKERS

DIGITAL ALARM CLOCK USES LSI

EASY TO BUILD RF Q-METER

SPECIAL CATALOG SUPPLEMENT

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From Sony research... a totally new turntable system

Sony PS-4750

Superb Fidelity from Today's Most Advanced Direct Drive

Audio experts the world over have been waiting for it . . . Sony's incredible PS 4750, the ultimate turntable system.

State of the art takes on a new meaning with the PS 4750, probably the quietest turntable ever made.

In one elegant design Sony has reduced rumble, feedback wow and flutter to minute levels far beyond hearing and virtually beyond measurement. Wow and flutter for instance is an amazing 0.03% (wrms.) Signal to noise is better than 70 dB (DIN-B).

Sony achieved this in a number of ways:
First, all the belts, pulleys, idler wheels and other paraphernalia used in conventional turntables to make the turntable spin at the record's speed, instead of the motor's, have been eliminated.

The Sony PS 4750 has no need for these troublesome, noisy and fluttering parts, because its slow-revving D.C. motor is directly coupled to the platter.

Speed accuracy takes on new meaning with another Sony breakthrough, the "Magne-disc Servo Control."

Through a unique multi-gap head, this system automatically reads turntable speed through speed detective signals magnet-coated on to the turntable rim. Should there be any deviation induced by fluctuations in power supply, it immediately "instructs" the servo motor to make micro-accurate adjustments.

Another triumph of Sony research is the very material used to make the cabinet and turntable, B.M.C., developed specifically for audio use because its damping and resonance characteristics are 30 per cent better than the conventional aluminium diecast. B.M.C. is also virtually free of expansion or contraction, freeing the design of any problems arising from temperature changes.

Sony innovation didn't stop there. Look at the revolutionary rubber disc supports. These insulation mats are of a unique design which firmly grips the record, effectively insulating the disc from vibration when the turntable revolves. By preventing vibrations, these mats contribute to the stereo effect and significantly improve presence.

The precision tonearm is a universal type which accepts all quality shells and cartridges. Some of the Sony PS 4750's other advanced features are: stylus pressure adjustment (0-3 g), anti-skate compensator, viscous-damped (up and down) arm lifter, see-through stroboscope, independent pitch control (+ 4% on both 33⅓ and 45) and large insulator legs for effective prevention of audio feedback.

If you've been waiting for the ultimate turntable, you need wait no more. The superb Sony direct-drive PS 4750 is here.

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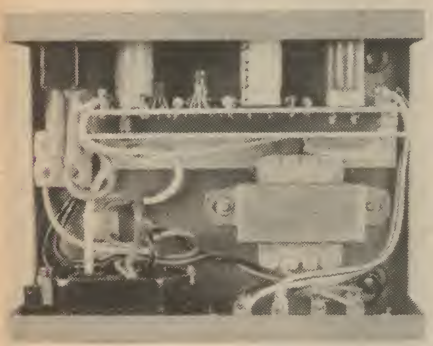
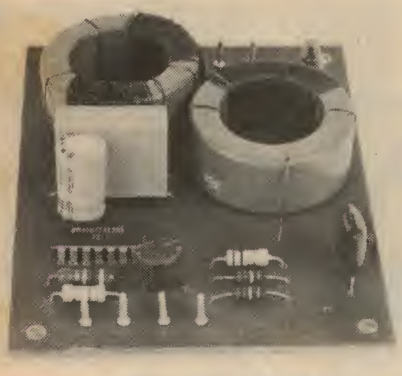
Australia's largest-selling electronics & hi-fi magazine

VOLUME 37 No 8



Developed in our laboratory, this loudspeaker protector will protect your expensive loudspeakers in the event of an amplifier malfunction. As well, it will eliminate switch-on ''thumps''. Details on page 34.



Designed for improving the signal to noise ratio from old movie sound tracks, this sharp-cut low-pass filter unit is compatible with the optical/magnetic preamp described last month. Constructional details on page 42.

On the cover

Our cover this month shows the Opus mini-computer which is being lent to students at Britain's Open University as part of a computer course. Developed for teaching purposes, the Opus offers many of the facilities found in commercial computers, including a store with 120 addressable locations, a 12-key keyboard, console switches and seven-segment displays. Cost is said to amount to only £13 per student. (Photograph courtesy British Information Service.)

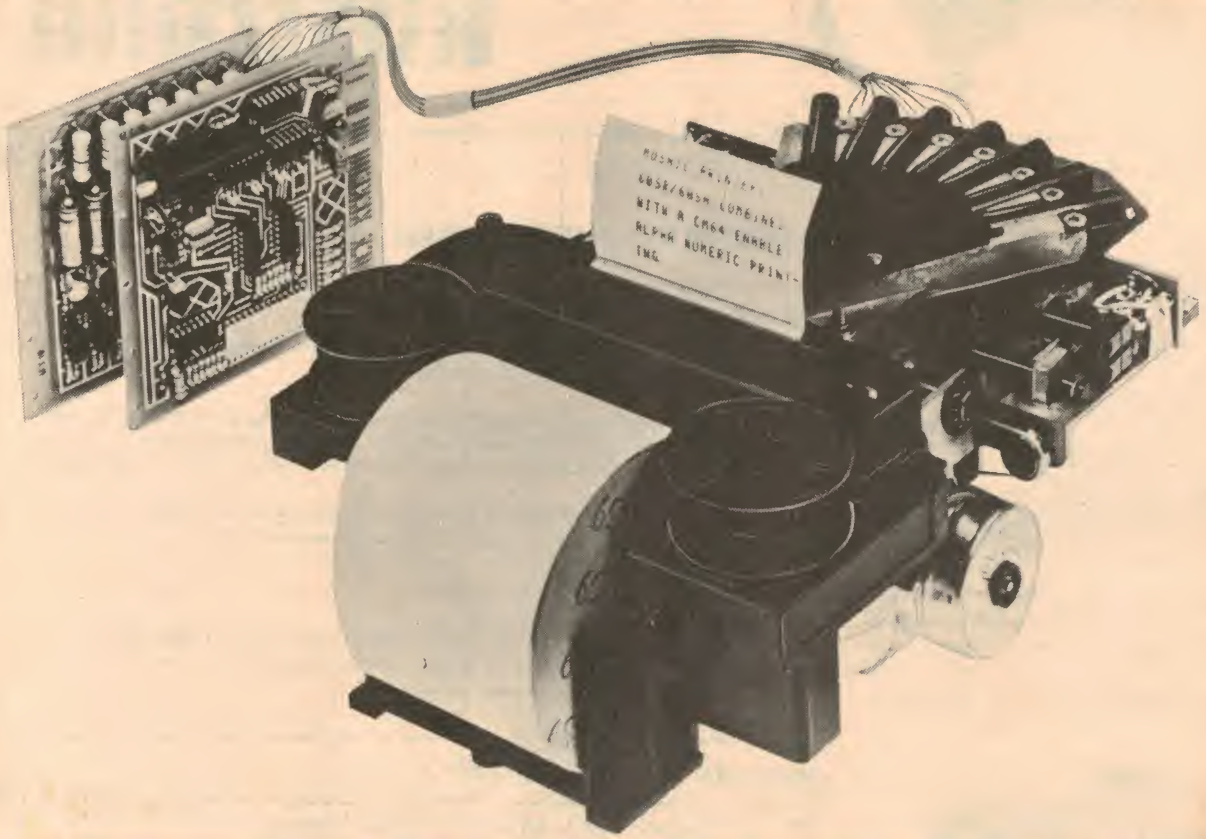
CONTENTS—NOVEMBER, 1975

world of electronics and hi-fi

projects and technical

regular features

"A low-priced high-speed print-out system, reliable and adaptable"



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Our 60 SA/SR mosaic printer is a low priced print-out system which surpasses many higher-priced competitors in performance and reliability. The system comprises a printer and drive/control module that prints a twenty-character line and returns the carriage within one second. Quietly!

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Editorial Viewpoint

Paperless news—but how soon?

In a recent public statement Mr Talbot Duckmanton the general manager of the ABC disclosed that his organisation is interested in introducing an electronic newspaper system in Australia, along the lines of the Teletext/Ceefax/Oracle system being tested in Britain. Readers who saw our rather timely article on this system in the October issue were no doubt in a good position to evaluate the proposal.

Certainly the broad concept of disseminating news and other service information in this fashion has a lot of merit. Conventional newspapers are undeniably wasteful as a means of achieving this end, particularly in view of the fact that only a relatively small proportion of the information in any one copy is actually read.

Naturally enough, conservationists have expressed concern for the large amounts of paper used in newspaper production. Wastage of material resources like paper is certainly involved, although some recycling does take place. Ultimately a proportion of newspapers is pulped and used to make lower grade paper products such as wrapping paper, but probably a major proportion is effectively lost.

No less important in the long term is the physical energy expenditure and human labour required not only to print newspapers but also to distribute them to the dispersed end users. The electrical energy used by the printing presses and the fuel used by the distribution transport are very significant, the more so because unlike paper they cannot be recycled.

Any system which replaces this "hard copy" approach with one involving electromagnetic propagation of the required information directly to the end user is bound to be less wasteful, and therefore more desirable in the long term. However this is not to say that the transition from one to the other will be an easy one, to be embarked upon lightly.

For one thing, as our article last month pointed out, there is a technological/economic "viability hurdle" to be overcome before systems like Teletext can become practical. Until the cost of adding the required decoding circuitry to TV receivers can be brought down to a few tens of dollars, probably by developing a suitable LSI integrated circuit, the system will not be attractive; yet the integrated circuit makers are naturally unwilling to make the huge investment necessary to produce the required LSI device, without assurance of a large market.

Another important consideration is public acceptance. Despite the highly inefficient nature of traditional newspapers, and the fact that very few people really need or take advantage of their "hard copy" presentation, old habits die hard. We humans are used to having our news impressed upon our own private wad of paper. We find it comforting, and I suspect it will take quite a lot of public education before we will be prepared to part with our ink-stained security blankets.

In short, then, while the idea of Teletext is a good one, we don't suggest that you hold off buying a colour TV set until you can have one with Teletext decoding built in!

—Jamieson Rowe

ON SALE THE FIRST MONDAY OF EACH MONTH.

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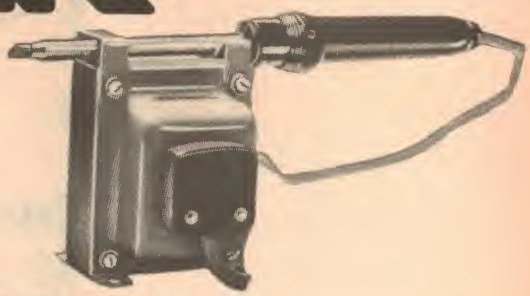
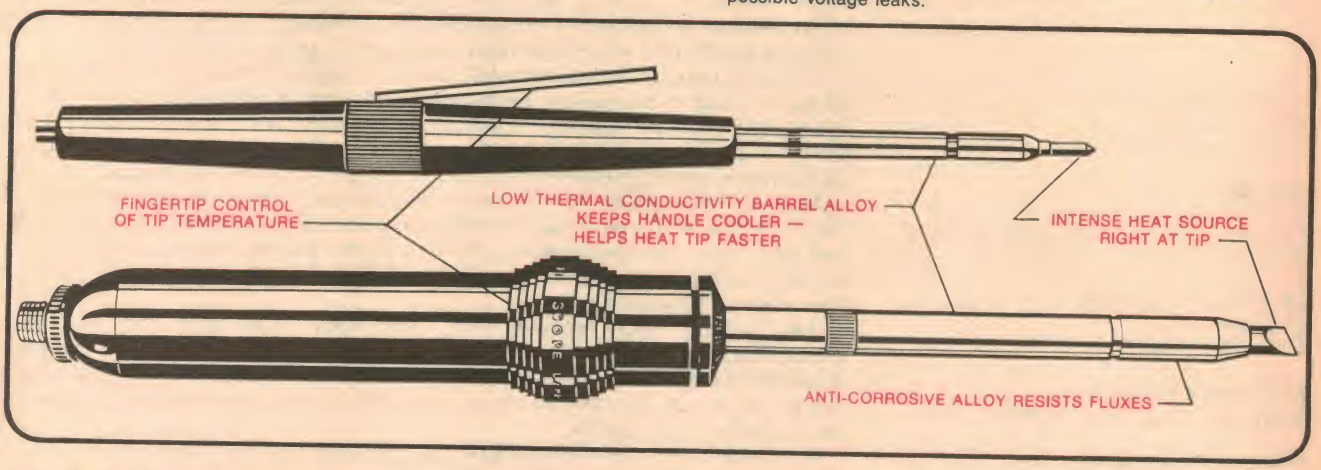


SCOPE TRANSFORMER
This transformer is specially designed to provide a safe low voltage power source for Scope Superspeed irons (and Vibroscope etching tools).
An earthed isolation shield prevents capacitive coupling with possible voltage leaks.



1. **Provide intense heating power:**
The patented heating concept located right behind the tip provides tremendous heat output to get the iron hot fast; then keeps the temperature under your control to complete every joint faster.

2. **Let you control the power:**
Should you encounter a heat sink which would rapidly drain away tip heat (e.g. thick metal or a need for plenty of molten solder) your finger switch provides another burst of heat to keep the copper tip at correct temperature. Normally only heavy irons have this capacity and take a long time to heat — and cool.

3. **Put this heating power right at the tip:**
A perfect iron has its heat source right at the surface of the tip — inefficient irons have their's up the barrel. The Superspeed range generate their heat on the copper tip itself, hence the intense concentration.

4. **Lets the tip run cool when not actually soldering:**
The tip stays tinned longer and lasts much longer because it switches off when you let go the handle. This feature plus a low heat conductivity stainless barrel keeps the handle cooler.

5. **One iron replaces several:**
With normal irons, you need several different sized irons to cope with various jobs and avoid the risk of dry or weak joints. Scope has designed an iron that does the work of any other iron from 10 watts to 150 watts.

SUPERSPEED USER SELECTION DATA

	Superspeed	Mini Superspeed
Low heat conductivity barrel	Yes	Yes
Non-corrosive barrel	Yes	Yes
Weight (without leads)	100 grm	50 grm
Heating up time for 40/60 soider from cold	5 sec.	5 sec.
Heating up time for aiuminium solder from cold (450°C)	14 sec.	12.5 sec.
Heating up time for hard silver solder from cold (630°C)	32 sec.	29 sec.
A conventional iron to do the same work would need to be—	up to 150W	up to 75W
Diameter of barrel	9.5 mm	6.4 mm
Choice of copper tip shapes	Yes	No
Cable lugs fitted	Yes	Yes
User Preference Guide:		
Electronic Service work	TV with vac. tubes	Solid State equipment
Electronic and Hi Fi hobbies	2nd pref.	1st pref.
Electricians and Linesmen	1st pref.	not recommended
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Listening to music in the home

When we listen we become engrossed in the music and, with good equipment, we can often obtain the same satisfaction that we would enjoy in the concert hall. Of course, there are differences between the real and the reproduced. Many of these we recognise as such; we come to terms with them and they do not intrude.

More serious perhaps are the distortions which we do not consciously notice but which are nevertheless continuously producing a contradiction between the actual and the imagined. They produce listening fatigue, a condition detrimental to the true objective. These distortions have little to do with the popular conceptions of HI-FI or LO-FI sound; on the other hand they have much to do with good or bad engineering.

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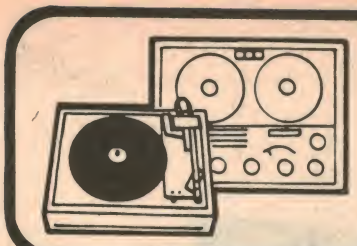


Hi Fi News

A new approach to organ design

Integrated injection logic (I^2L) and emitter coupled logic (ECL) are currently making headlines in the technical press but, already, they have found their way into prototype electronic organ circuitry. A new device from Philips, Eindhoven, offers a potential alternative to the octave generator ICs which are, themselves, relatively new.

by NEVILLE WILLIAMS

Broadly speaking, the designer of an electronic organ or other such instrument has three main design options.

The first is to use separate oscillators to provide the various pitches, the advantage of the method being that separate oscillators can provide some randomness of pitch and phase, equivalent to that in a pipe instrument.

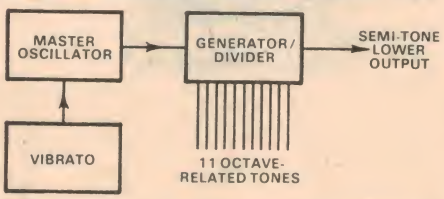
Offsetting this advantage is the fact that periodic overall tuning is necessary and the pitch can only be modified by complete re-tuning. Nowadays, this approach is mainly the preserve of large, elaborate instruments envisaged as a direct substitute for their pipe counterparts—either classical or popular.

A second major approach—and a relatively new one—is to acquire and store information about waveforms in a digital form, typically involving read-only memories (ROMs) and punched cards. When a player operates the quite ordinary registration tabs and playing keys, internal computer style technology invokes and assembles the required digital information. It is then transformed into an analog signal and applied to conventional amplifiers and loudspeakers.

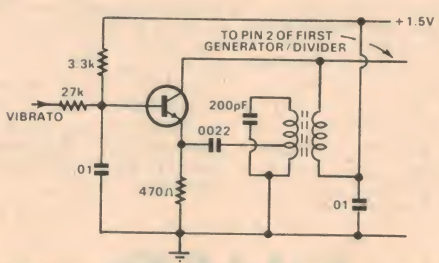
This approach makes available to the designer a whole array of sophisticated digital technology, which would otherwise have no place in organ design. However, it has important implications in terms of signal component frequency and phase, because data repetition rates must relate ultimately to the basic "clock" frequency. It obviates any problems with tuning or tuning drift, facilitates increments in overall pitch but also eliminates any natural randomness between the tone sources.

The third major approach—and far and away the most popular—is to provide the twelve basic semitones for an octave at or above the top frequency range of the instrument. Frequency dividers are then used to generate the basic tones for progressively lower octaves.

Originally, ordinary tuneable L/C oscillators were used to provide the top reference octave, adding up to an instrument which required limited tuning, allowed for some randomness between intervals within the octave, but no randomness between the same note in different octaves. The basic pitch could only be changed by re-tuning the twelve master oscillators.



Block diagram of the new Philips prototype organ tone generator. Driven by an 8MHz (approx) oscillator, the first chip provides all "C" tones required by the organ, if necessary frequency modulated for vibrato. It also provides an 8MHz drive for the next chip, providing all the "B" tones.



The basic 8MHz (approx) oscillator may be crystal locked or may be an L/C circuit, as desired. The circuit suggested by Philips has adequate stability, remembering that any slight drift affects the pitch of the organ as a whole, not the critical intra-octave intervals.

More recently, the twelve master oscillators have tended to give place to a single master oscillator, usually at about 2MHz, followed by logic circuitry dividing down to a reference super-octave of tones closely approximating the tempered scale. As before, a chain of flip-flops divides down each note of this reference octave to provide all the basic frequencies required by the keyboards. The high frequency master oscillator can be variable tuned to provide desired changes in pitch, or it can be crystal locked, or switched in predetermined increments.

Whatever the detail, however, all tones in a master-oscillator-divider type organ are frequency and phase-interlocked and designers have to resort to phase modulation of one type or another to simulate the randomness of an acoustic instrument.

For the many manufacturers of this type of instrument, some kind of an ultimate seemed to have been reached, not long ago, with the release of integrated circuits which contained all the logic circuitry necessary to produce a reference super-octave from one 2MHz crystal oscillator or its equivalent. Other ICs provided the necessary divider chains to supply the manuals and pedal clavier. Circuitry which had previously involved large arrays of valves or, later, discrete transistors, was therefore concentrated in a few ICs on a relatively modest PC board.

Now, it seems, Philips are working on an approach for a master-oscillator-divider organ which will offer still further economies. Instead of the complex and relatively costly IC to generate the super-octave, they have come up with one using I^2L and ECL technology which accepts the signal from a master oscillator at about 8MHz to produce twelve outputs: eleven octave-related tones necessary to supply a particular note in all manuals, together with one output which is lower than the original 8MHz drive signal by the twelfth root of 2, or one semitone.

Typically, one of the new 16-pin ICs might be fed from a master oscillator at a frequency of 8.572846MHz. Dividing by 2^9, it would produce 16744Hz; by 2^{10} it would produce 8372Hz and so on for all the "C" notes down to 2^{19} and an output at 8.091Hz. In addition to these audio frequencies, the IC would also produce an output 8.0917202MHz, which is suitable for driving another exactly similar IC; this would produce all the "B" notes and, in turn, drive for the "B-flat" IC.

While, on the surface, it might appear that the new approach merely distributes the same functions differently in a similar number of IC packages, the early implication seems to be that an economy will result from using twelve of the new

(and identical) ICs, which require no external components other than the master oscillator and a simple series resistor between the outputs and the keying circuitry.

A further advantage is that, by dividing down from 8MHz rather than the more usual 2MHz, a closer approach can be achieved to a mathematically precise tempered scale. The maximum deviation occurring in any octave is 49 parts per million or .0049%.

For straightforward instruments, the bank of ICs can be fed from a relatively simple L/C oscillator, which can be rendered intrinsically very stable by careful design, while nevertheless allowing its frequency to be modulated to provide vibrato effects. Since all pitches are derived from the one master oscillator, any deviations, whether deliberate or incidental, affect the overall pitch of the instrument but not its internal frequency relationships.

Typically, the entire tone generating system can be assembled on one PC board measuring 4 x 30cm.

For more elaborate instruments such an economy of space and circuitry makes it relatively easy to incorporate additional generator systems. depending on requirements, these can be used to obtain vibrato and non-vibrato options, "celeste" or off-tune "chorus" effects, glide tone effects and so on. Again, with an additional divider circuitry available, the whole system can be stepped towards or away from the master oscillator, effecting transposition of all the keyboards a semitone at a time.

QUADRAPHONICS: While there are plenty of "knockers", Edward Tatnall Canby, writing in "Audio" magazine, seems more keen than ever about quadraphonic systems. His renewed enthusiasm flows from the latest generation of quadraphonic equipment which he has been closetted with—CD-4, SQ and QS.

While he is more enthusiastic than specific, the message that comes through is that the new generation of equipment really works, with controls, circuit techniques and automatic this-and-thats which wrap up what might have been seen before as loose ends.

Canby isn't inclined to argue too much about the particular system; each has its plusses which show up most strongly with certain types of program material but, for Canby, any kind of quadraphonic is likely to be preferable to plain two-channel stereo.

He admits that the new hardware is gimmicky and costly but, for him, the important thing is that it seems to have solved the outstanding technical problems. From here, it should be a downhill run to wider public acceptance, as the hardware is simplified and cheapened, while still doing the same job!

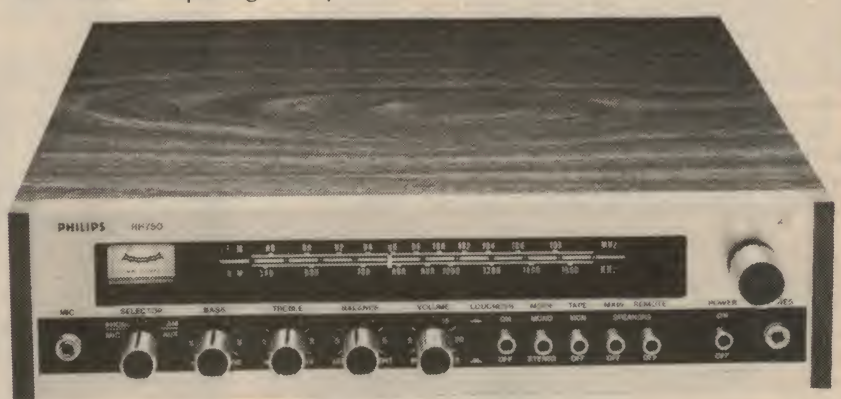
JVC, meanwhile, is optimistic about 4-channel but certainly doesn't see the future as a "downhill run".

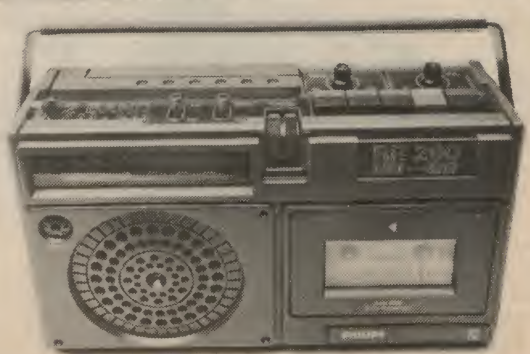
NEW PHILIPS AUDIO EQUIPMENT

Backed by the Company's largest-ever promotion for their audio products, Philips have recently launched a variety of new items of special interest to Australian hifi enthusiasts. Included is the motional feedback loudspeaker and the electronic turntable mentioned in July.

Pictured above is the complete domestic system 850, which is expected to market at a recommended retail price of $440. It includes an AM/FM radio, with capital city AM stations marked on the dial. The amplifier has all the usual controls and facilities for connection to external tape equipment.

For those requiring a separate tuner/amplifier, Philips are offering the RH750 pictured below. With a power output of 13.5W per channel into 4 ohms, the RH750 has facilities for phono, tape and microphone input, and all the normal controls expected in a hifi installation. Both tuners—AM and FM—have built-in aerial provision, adequate for all but poor locations. A tuning meter at the top left corner of the panel serves both reception modes. Rated signal-/noise ratio for the FM tuner is 65dB and stereo separation 34dB. For the AM tuner, the rated signal/noise ratio is 45dB. Recommended retail price for the RH750 AM/FM Tuner/amplifier is $239.00.





Conforming to the currently popular "military look" Philips model RR260 (pictured at right) offers AM and FM radio, combined with a full cassette recorder with built-in condenser microphone. There is provision for external plug-in microphone and external speaker, headphones and remote control. Recommended retail price is $99.00.

HIFI NEWS

At the most recent US hifi show, a JVC survey indicated that over 50% of prospective customers were interested in 4-channel sound but lost interest when they came up against dealer confusion apathy.

Accordingly, JVC America is currently setting up so-called "Quadracenters" throughout the USA intended to give customers the opportunity to hear the whole range of their 4-channel equipment under properly controlled conditions: receivers, amplifiers, demodulators, tape decks, loudspeakers, etc.

The Quadracenters will be staffed by salesmen who have been through a course covering 4-channel concepts and installations. They are backed by a special "Hot-Line" service, where customers have the opportunity of making toll-free calls to the JVC National Quadracenter aimed at helping them with any difficulties related to 4-channel sound.

QUAD RECORD INVENTORIES: Record company attitudes are continuing to shift in the matter of the release and stocking of quadraphonic versions of new releases.

As noted last month RCA have moved away from their original plan to rely on the CD-4 pressings, where issued, to cover the complete market: quadraphonic, 2-channel stereo and mono.

Superficially, this is possible because the extra information in the supersonic FM channels is ignored by non-CD4 equipment. All signals in the main channels simply revert to the front arc, as it were moving straight forward, the end result being a close approximation of what one would expect from a 2-channel stereo version.

As indicated RCA ran into a credibility problem: customers didn't seem to get the message that the discs were compatible; when they couldn't find an ordinary "stereo" version, they settled for something else. And, of course, there were those who knew the technical story but had reservations about the durability of pressings carrying a supersonic modulation which, for them, was redundant. As a result, RCA have amended their "CD-4 only" policy and have issued "stereo" versions where it seemed appropriate to do so.

Now comes the news that EMI in Britain have made just the reverse decision with a number of their quadraphonic classical releases. Rather than issue separate "SQ" and "stereo" versions, EMI have produced stereo/quadraphonic pressings carrying a rectangle symbol. It parallels the position noted for France, where SQ pressings are often sold with ordinary stereo labelling.

Unlike the CD-4 discs, the quadraphonic information lies totally within the audio band and will be reproduced in the stereo version, however appropriate or peculiar the various phase relationships. The producers have to study each recording on its merits and arrange the mixdown so that the end result is acceptable in all playing models. From reviews published overseas, the exercise has proved to be entirely successful.

COPYRIGHT SITUATION: Prompted, fairly obviously, by recent imports and seizures of "pirate" cassettes in Australia, the ANZ Musical Copyright Agency has issued a letter summarising the official copyright situation covering records and cassettes of musical works. Over the signature of Manager A. J. Turner, the letter reads as follows:

It has become apparent that not all persons engaged in the business of importing, distributing or retailing records or pre-recorded tapes obtained from overseas suppliers are aware of their responsibilities under the Copyright Act 1968. The following information has therefore been made available on behalf of this Agency's principals to publicise those responsibilities and the facilities provided by this Agency to assist all such persons in meeting their responsibilities.

(1) ANZ Musical Copyright Agency is the licensing division of AMPAL and represents the majority of Music

PIONEER CS-911

Employing no less than six separate drivers, the Pioneer CS-911 loudspeaker system (pictured) is aimed at the top end of the hifi market. The bass end is handled by a 15-inch (38cm) woofer, while two 10cm roll-surround units cover the mid-range.

For the top of the range, three more drivers are used: one 77mm cone tweeter and two 57mm cone "super tweeters".

Rated frequency range is 30Hz to 22kHz, while the power handling capacity is given as 150 watts. Impedance is 8 ohms. 3-position switches on the front panel, behind the removable grille, permit the middle and treble balance to be varied according to user preference.

The system features a new carbon fibre cone material, developed jointly by Pioneer and Toray Industries of Japan. Basically, the new material is produced by heat processing organic fibres to produce carbon fibres, then surface processing with polyvinyl alcohol to ensure good integral adhesion. Pioneer say that the carbon fibre cones offer a high modulus of elasticity, combined with mechanical strength, low density and weight, and high dimensional stability.

For further information: Pioneer Electronics Australia Pty Ltd, 178-184 Boundary Rd, Braeside, Vic 3195. Tel 90-9011.

What is the best kind of bearing for a playing deck? The one likely to produce the least rumble? The answer, perhaps, is: no bearing at all, in the mechanical sense; instead, the turntable is supported by the repulsion effect of a magnetic field. A British "Gale" turntable of this type was exhibited recently at the Sydney Hifi show, while a new Stanton design at left uses magnets both to support and to drive the turntable.

Publishing Companies who own or control the copyrights for Australia in most music in current use. A major purpose of the Agency is to provide for the music industries a convenient central office for the licensing of the importation and sale of recordings of musical works and for the collection of royalties in respect thereof.

(2) It is an infringement of copyright for any party to import into Australia for re-sale any records or cassettes containing copyright musical works without the prior permission of those who control the relevant copyright for Australia or their representatives. This permission cannot be given validly by an overseas exporter who only controls copyright in the country of manufacture or export. (Copyright Act, section 37.)

(3) Any wholesaler or retailer who sells imported records of music which have not been properly licensed for importation by the Australian copyright owners can also be liable for infringement of copyright. (Copyright Act, section 38.)

(4) Applications for permission to import records and cassettes containing copyright music should be addressed to ANZ Musical Copyright Agency, P.O. Box Q123, Queen Victoria Building, Sydney, N.S.W. 2000. The detailed information to be included in such applications is available upon written request to the Agency.

(5) Wholesalers and retailers, in order to avoid risk of liability, before purchasing records made in any overseas country, should enquire from this Agency as to whether such records have been imported with proper copyright clearance.

(6) This Agency is available to provide information and assistance to any importer, wholesaler or retailer in relation to the copyright in musical works and enquiries will be welcomed.

PORTABLE PLUS: Portable transistor radios have been decked out with AM, FM and shortwave bands, cassette tape facilities, a wide variety of styling features and just about everything else one could think of. But Matsushita Electric's latest National RF-1300 has an inclusion that certainly would not have occurred to many up to this point in time: an electronic rhythm generator!

Borrowing the technology developed for electronic organs, the unit offers a choice of eight different rhythms—twist, waltz, ballade, etc—produced by synthesised cymbals, snare drum, bass drum and high hat.

The model has provision for interconnection to microphone, electric guitar, tape recorder, record player, or another radio, and has provision to adjust the tempo to the precise speed required. Presumably the user can superimpose a locally generated beat on external program material or just listen to the beat for as long as he/she likes.

Nor are they stuck with a few milliwatts of power. The RF-1300 supplies 5 watts to a 16cm twin-cone speaker. It can be operated from AC mains, car battery supply or ten D-size torch cells.

NOW WE SCAN SPEAK! It was announced some time ago that Ortofon, well known for their phono cartridges and playing arms were planning to enter the loudspeaker business. The basis for the expansion has now been revealed.

After lengthy negotiations, Ortofon Manufacturing A/S has taken over Scan Speak, the Danish loudspeaker manufacturer. Scan Speak has been the supplier to many local Danish companies but has also marketed the Scansonic speaker systems on an international basis.

Ortofon's Managing Director, Erik Rohmann, has assumed control over the total company, now employing 400 people, while Bent Thomsen is Sales Manager with responsibility for the Scansonic product program.

Computerised modelling & laser techniques aid loudspeaker design

Currently considered the weakest link in the audio reproduction chain, loudspeaker systems are coming in for a great deal of research and development attention, with both Philips and Wharfedale using lasers to show up standing wave patterns in cones.

Although the quality of loudspeakers has been considerably improved in recent years, loudspeaker design has been more a question of intuition and practical experience, rather than a quantitative understanding of the behaviour of loudspeaker cones. Engineers have long had to deduce what might be going on in cone and voice coil assemblies, relying on roundabout means and subjective judgements to confirm those deductions.

Reacting to this situation, Philips Research Laboratories in Eindhoven, The Netherlands, has developed a new computerised modelling technique as a step towards overcoming loudspeaker design problems.

The new modelling aid, developed by F. M. Frankort, enables the designer to perform a theoretical analysis of loudspeaker behaviour. This is done by using a computer to solve 12 simultaneous differential equations for a large number of frequencies and for various types of speaker cones.

In this way it has proved possible, for example, to calculate the frequency characteristics of the sound pressure and the radiated sound power as a function of the geometry and properties of the cone material.

In order to verify the theoretical results on an experimental basis, mechanical vibrations of the cone were visualised holographically (see photographs). In addition, the velocity of the coil, the sound pressure, and the sound power levels of the loudspeaker were recorded as a function of frequency.

At low frequencies the cone vibrates as a rigid entity. Above a certain frequency, standing waves appear on the cone surfaces. These can clearly be seen in Figs. 1 and 2.

Fig. 1 is an interferogram, obtained holographically, of a cone driven at a frequency of 2000Hz. At this frequency, nodes and antinodes begin to appear along the periphery of the cone.

In Fig. 2 the drive frequency was 9000Hz. The whole surface of the cone is now covered with patterns of nodes and antinodes, and the cone radiates little sound.

Experimental results agree quite well with theoretical predictions. The graph illustrates the satisfactory agreement obtained between the measured and calculated frequency response of the sound pressure level (Lp) on the axis of an 8in loudspeaker in a box (solid line, experimental; dashed line, theoretical).

Fig. 1: interferogram of a speaker cone driven at a frequency of 2kHz.

Fig. 2: interferogram of a speaker cone driven at a frequency of 9kHz.

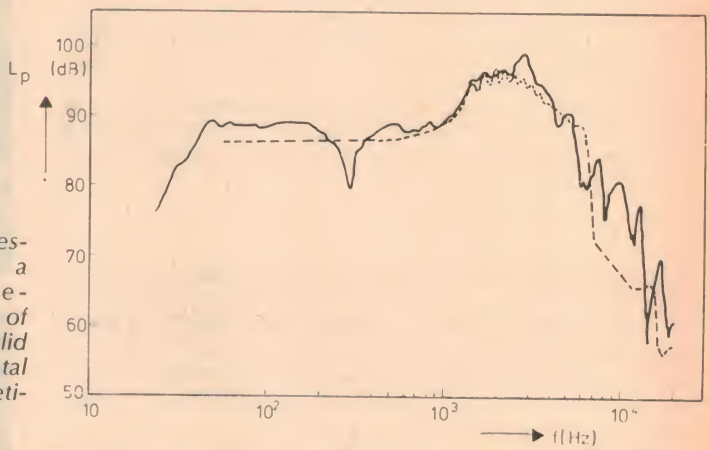


Fig. 3: sound pressure level Lp as a function of frequency on the axis of an 8in speaker. (Solid line experimental dashed line theoretical.)

Philips state that the new computerised analysis technique could eventually lead to further improvements both in the method of design and in the quality of loudspeakers.

Meanwhile, at the Wharfedale factory in England, only a stone's throw from where Gilbert Briggs created the brand—largely on subjective evaluation—Technical Manager Ken Russell and Senior Projects Engineer Alex Garner are combining the traditional approach with modern instrumentation and laser analysis.

To give some direction for their current work, the Wharfedale Research Department produced a brace of "black boxes" which are used in conjunction with a high quality amplifier/loudspeaker system to introduce identifiable resonance and intermodulation effects. The subjective significance of these effects can be gauged, as necessary, by enlisting the aid of listening groups, expert and otherwise.

By such techniques the Wharfedale team have been able to establish that damaging colourations can be due to low-Q resonances in the mid-range—the kind of effect that has traditionally been overlooked or dismissed somewhat lightly when viewing ordinary pen-plotted response curves. Armed with this kind of information, the laser becomes a valuable tool in exposing how such effects might be occurring in typical cone structures.

Using techniques developed by holography expert Peter Fryer, PhD, a single laser plate, similar in appearance to those in Figs. 1 & 2, can be made to yield the equivalent of a 3D movie as the eyes are moved to view the hologram from different angles. Already the team has been able to pin-point the effects of voice coil terminations in tweeters, and a variety of other effects in sandwich cones, which can be countered once they have been positively identified.

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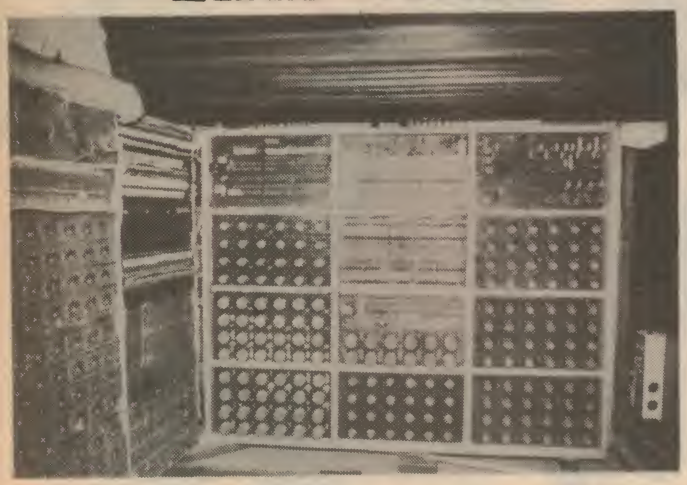

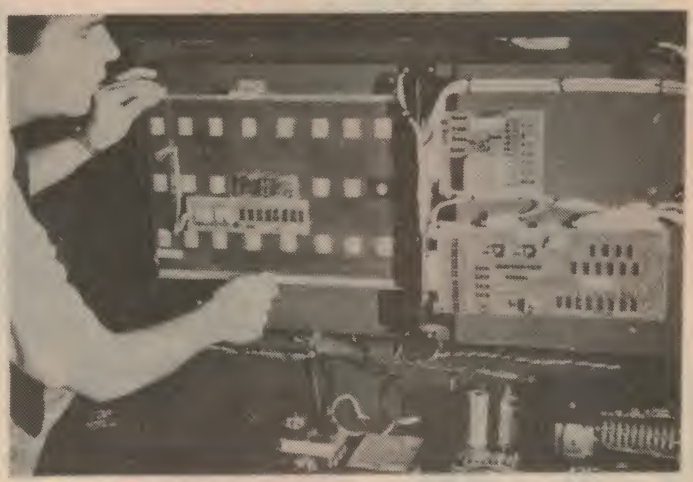

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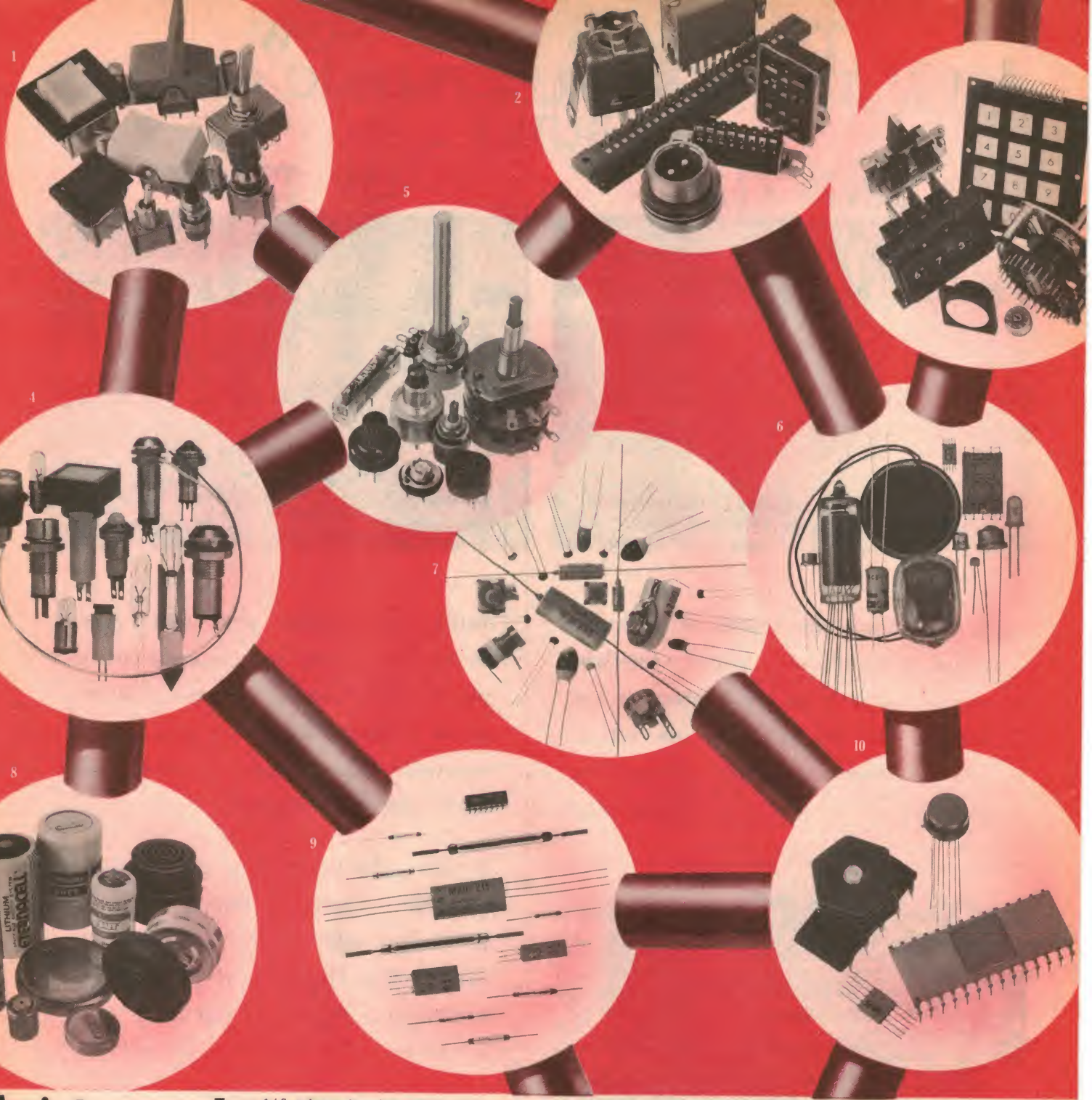

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NOUVEAU NEU NEW!

Cassettes and tapes from BASF

"New", in any language, seems to be the theme behind the latest tape products from BASF, marketed in Australia by Maurice Chapman & Co Pty Ltd. The release includes both cassettes and reel-to-reel tapes for the advanced enthusiast or for professional use.

For many who regard coated magnetic tape as a post-war development, it may come as something of a surprise to read in their product data that BASF supplied the first 50,000 metres of such tape to A.E.G. in 1934. The development program behind their latest "LH Super" tapes climaxed in 1974—the 40th anniversary of the initial shipment—with worldwide release being effected in the current year of 1975.

While it may be possible to nominate certain milestones in the 40-year history of coated magnetic tape, from the viewpoint of the user the story has really been one of gradually improving technology which has put each new generation of tape a little ahead of the last. Thus, while this year's tape is only a little better than last year's, both are a lot better than the tape available ten years ago, or twenty, or thirty, or that initial run back in 1934!

Interestingly enough, those who purchase and appreciate today's high quality audio tapes owe a lot to tape users in other fields. The demand for a tape which could store frequencies up to 6MHz for television recording forced tape manufacturers to pursue technology and formulations aimed at securing a frequency response far beyond anything that would normally have been sought for audio work. But the know-how that is now producing top quality video tape has taken most of the hassle from cassette tape capable of retaining the full audio range (typically 15kHz and beyond) at a scanning speed as low as 1-7/8ips.

Similarly, computer involved customers have demanded a tape which is notable for its freedom from "drop-outs". A bubble in the coating, or a tiny fragment which flakes from the surface of an audio tape may not even be noticed, while a similar falling in a video tape may produce only a slight flick on the screen. But, in a computer situation, imperfections may drop-out vital "bits" of digitised information, leading to possibly serious errors. Once again, technology aimed at minimising drop-outs for computer customers has contributed to the ultimate quality of audio and video tapes.

As far as their new LHS tape is concerned, BASF claim that the coating is "pure maghemite", involving iron oxide particles smaller and more evenly graded than ever before. Largely because of this, the intrinsic tape hiss is reduced by something over 2dB relative to earlier standards. Considered alone, 2dB is a very modest improvement but it is one more step in the right direction.

BASF also claim an improvement in their coating techniques which has resulted in a greater density of particles in the coating, with good magnetic orientation. This has made possible a wider, flatter frequency response and a 3dB increase in the maximum recording level as determined, for example, by an arbitrary 5% distortion limit.

Taken together, the lower noise and higher "overload" ceiling offer a better quality recording for a given dynamic range, or improved dynamic range within previous concepts of signal/noise ratio and overload.

Special attention has been given, also, to the mechanical aspects. A "super smooth" finish, self lubrication and close tolerance components in the housing ensure a long service life, with a minimum of trouble, from the new BASF LHS cassettes. They are available as C-60, C-90 and C-120, styled in black inside a black flip box.

As an aid to storage, BASF are also offering "Modul-Lock" units, a moulded stand accommodating four cassettes. They can be used free-standing on a table or shelf or can be interlocked to form integrated storage units—either free standing or attached to a wall.

The new range of LHS reel tapes takes advantage of the improved magnetic formulation and technology and shows a proportional improvement in performance characteristics, relative to previously published figures.

Two figures are particularly stressed by the makers:

The cohesive force is equal to 320 Oersteds—the magnetic force which must be applied by the erase head to ensure that the tape has been fully demagnetised and "cleaned" prior to a new recording. The figure of 320 Oersteds, according to BASF, ensures that LH-Super tape will operate on all recorders without special provision or adjustment.

The relative remanence is 80%—an indication of the high proportion of the magnetic energy applied to the tape which is retained in the coating. The result is a higher level on playback and less likely intrusion of "noise" arising in the playback amplifier.

The new open reel tape is being marketed in two forms. The long play type is designated as LP35LHS and comes on a 13 cm spool accommodating 270 metres, or an 18 cm spool accommodating 540 metres. Because of its thicker base, this tape is recommended for hard wear or for machines which may impose higher than average tensions upon it.

Where this is not a problem, the very flexible double-play tape DP26LHS is recommended, offering as it does an increase to 360 metres and 730 metres on the same spool sizes.

Further information on the new BASF LHS tapes may be obtained from Maurice Chapman & Co Pty Ltd, 276 Castlereagh Street, Sydney 2000.

The case for cassettes...

Who better than Sony to develop a cassette deck that genuinely rivals open reel in performance. After all, Sony made its name by leading the way in open reel technology. That same brilliant Sony engineering now brings you the TC-177SD, a superb instrument for cassette fans.

Consider: Wow and flutter less than 0.07%; Frequency response 20Hz to 20kHz; Signal to noise of 55dB (and even better with Dolby on). All that and cassette convenience!

Sony did it by combining its proven closed-loop dual capstan drive with a number of remarkable new cassette deck developments. First, the TC-177SD has three heads for separate erase, record and replay. This ingenious design avoids the compromise between record/playback head design and permits A/B monitoring of sources and just recorded signals for instant checking.

Second, the TC-177SD is unique in providing Bias/Equalisation switching so that Sony's fantastic new Ferri-Chrome and the normal chrome dioxide tapes can be "tuned" for ideal balance in recording. Naturally Dolby noise reduction is inbuilt. But with a typically Sony difference; four Dolby circuits provide such super features as Dolby monitoring, there's a Dolby oscillator for optimising the particular tape in use, and for Dolby-encoded broadcast FM.

Functions, too, are up to the highest reel standard: feather touch control buttons; FM multiplex filter; full mixing for microphone and line inputs; peak level indicators are LED to complement the Limiter and 2 large VU meters; a memory counter for auto location of desired part, and there's an auto shut-off.

Everything you've wanted for easy, professional-quality cassette recording is now together in the fabulous Sony TC-177SD.

See it and hear it, soon.

Sony TC-177SD puts 3 heads together

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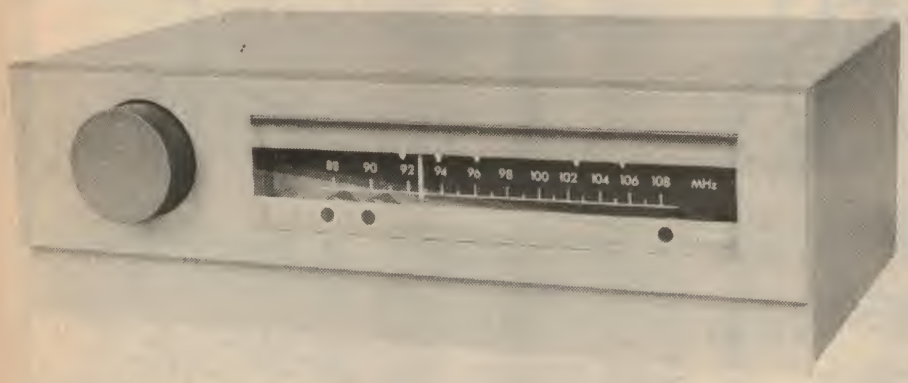
Quad FM3 Tuner

Quad is the brand name of the Acoustical Manufacturing Company Limited of England, which has long had a high reputation in the high fidelity field. Here we review the latest model with the Quad name, the FM3 tuner which has complete stereo multiplex facilities in a simple unadorned case.



Compared to the majority of high fidelity equipment sold these days, the Quad FM3 tuner must seem to have quite a spartan appearance indeed. In this aspect it matches the styling of the Quad 33 stereo control unit.

Colour of the front panel is a hard-to-describe earthy tone, which is offset by an orange stripe at the top and bottom of the dial scale. The dial scale is screen-printed in white. A single large knob adorns the front panel and as you might have guessed it is used for tuning. Pressing the knob and turning also allows the five station markers to be set to any point on the dial.

In keeping with the restrained styling, dimensions are also modest at 260 x 92 x 165 mm (W x H x D) including knobs and rubber feet. Mass is 2.7kg.

Tuning meters are not provided. Instead, two indicator lights on the left hand end of the dial provide accurate indication that the FM 3 is correctly tuned to the centre of an FM station. A similar light at the right-hand end of the dial is the stereo indicator.

While the heavy diecast front panel is spartan in appearance, the plastic dress panel on the rear of the FM3 seems almost "busy" by comparison. It is clearly labelled, as can be seen in the photo.

A small knob is provided to vary the muting threshold between RF signal inputs of zero and 250 microvolts. This is a useful feature which is not found on many tuners. When set correctly it enables a minimum of interstation tuning noise to be produced while still enabling reception of all desired stations. Admittedly it is not important at the moment in Australia.

As can be seen from the photograph of the interior, two large PC boards accommodate the circuitry. They are neatly laid out and all components are labelled clearly. One board accommodates the decoder and power supply while the other contains the RF section and detector.

The rear panel of the Quad FM3 is a plastic moulding which shows all labels clearly.

While the circuit is relatively straightforward there are a number of interesting features. The RF section is fairly conventional. It has 75 ohm coaxial input or 300 ohm balanced input. Two dual-gate MOSFETs are employed, one in the RF stage and one in the mixer. The local oscillator is an NPN transistor operating in common-collector mode and the oscillator signal is injected into the second gate of the mixer MOSFET.

There is no AFC (automatic frequency control). Apparently Quad are of the opinion that it is not necessary and this is perhaps arguable. The stability of modern solid-state FM front ends is such that the extra circuitry required is really not essential, even though there are not many components involved. There is also a disadvantage with AFC in that it should ideally be switched out when tuning into a station and then switched in, which is more complicated than merely twisting the knob.

IF output (at 10.7MHz) from the mixer stage is fed via an IF transformer to a multi-element ceramic filter and thence to the IF amplifier, limiter and detector integrated circuit (RCA CA 3089 or equivalent).

A DC voltage from the detector is used to drive the tuning indicator circuitry, which consists of seven transistors. Basically the tuning indicator is a differential amplifier. Balanced output from the differential amplifier drives two Darlington emitter-followers which feed miniature incandescent lamps. When tuning is correct both lamps have the same brilliance.

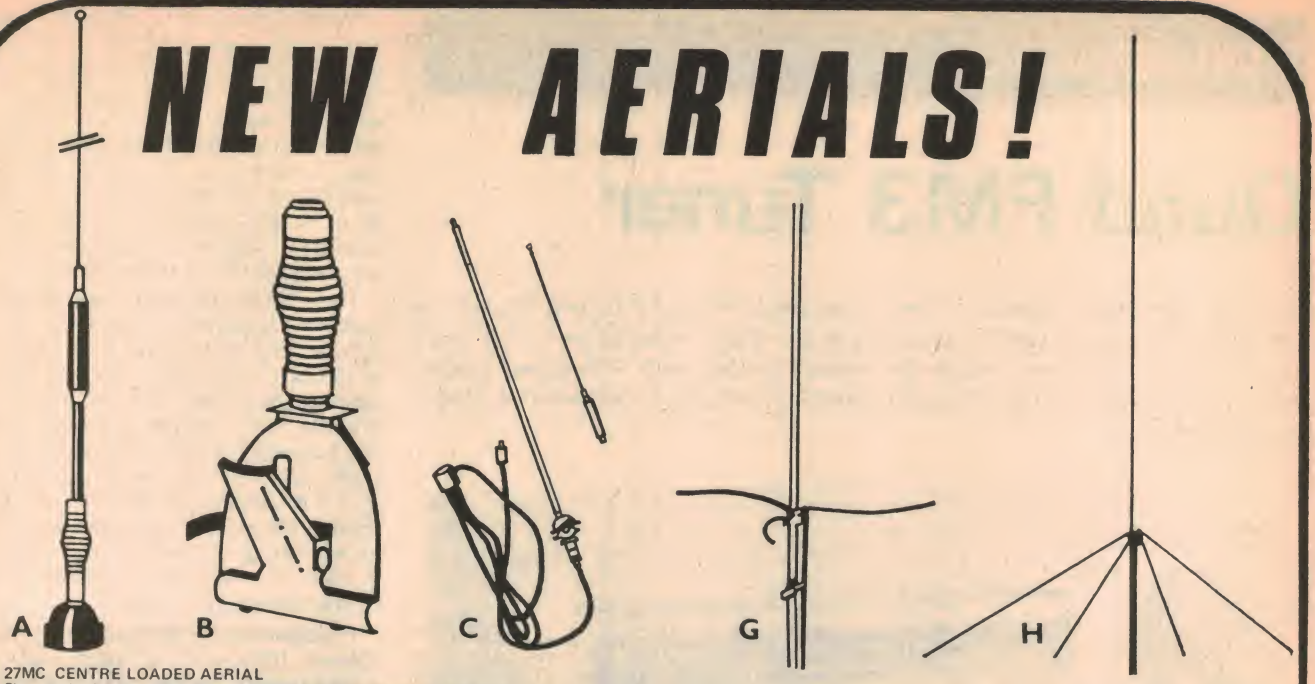
Part of the alignment procedure of the FM3 is involved with setting the tuning indicator circuitry so that the two lamps have equal brilliance. While the system works very well in practice and is equally effective as a centre-reading meter, we wonder why LED indicators were not used in place of the lamps. Besides being potentially more reliable, they could be more attractive. More on that point later.

When the tuner is not receiving a signal (eg, when tuning between stations) there is a lot of high frequency noise at the output of the detector. This is amplified and detected and used as a control signal to mute the input signal to the decoder and to extinguish the tuning indicator lamps.

The multiplex decoder uses the well-known Motorola MC1310P integrated circuit in a normal configuration, albeit with a few refinements. Instead of disabling the internal VCO to obtain a mono signal from the decoder, the audio output from the detector is fed to an emitter-follower and thence to a separate pin of the output DIN socket. This can then be connected to a separate input on the main amplifier. Thus "direct mono" operation can be obtained, for higher quality in noisy signal conditions.

Left and right outputs from the decoder IC are passed through active filters with an ultimate slope of 24dB/octave to

NEW AERIALS!



A **27MC CENTRE LOADED AERIAL**
Short on size, but not on signal! Just 20 inches long. Includes centre loading coil, stainless steel spring and beautiful black phenolic base on the new "Quick Grip" mount. Solderless lead connection with a PL-259 connector at set end of coaxial cable. **$19.50**

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C **CB—AM. COMBINATION AERIAL**
Cowl mount antenna. Serves two functions in one—Citizens Band AM broadcast! This item eliminates the need for two antennas. This single sturdy heavily chromed antenna fits easily into 7/8" to 1-3/16" hole left by the auto antenna. Only 46" long in operating position (collapses to 31"). The 313 incorporates an automatic dividing harness which includes a 1' low loss cable to your AM set, a 2' cable to your CB set, and a 5' cable to your antenna (PL-259 included). The divider coupling unit fits snugly up under the dash. **$34.95**

D **27MC BASE LOADED CLIP ON WHIP**
This short 20" whips fits transceivers with 9/16" or 3/8" aerials. Simply slips over closed aerial stub-base loading coil gives excellent performance. **$12.00**

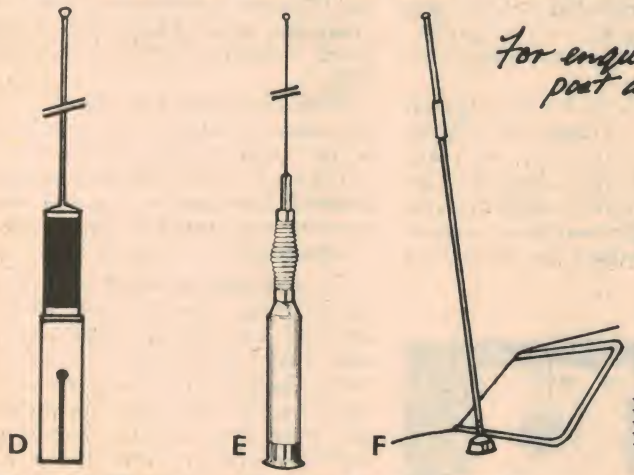
E **27MC BASE LOADED ON SPRING**
Base loaded antenna with attractive grey jacket and chrome fittings. Stainless steel whip with adaptor that provides for 1-1/4" fine tuning adjustment. A stainless steel spring protects against shock. Antenna easily snaps into "Quick Grip" mount. Solderless lead connection at antenna PL-259 at set end of coaxial cable. Only 46" high.
Frequency: 27 MHz. VSWR: Less than 1.5:1. Impedance: 50 ohms. Weight: 1.7 lbs. **$29.50**

F **27MC TRUNK MOUNT WHIP**
Solid fibreglass whip extremely tough. Centre loading wound on whip—covered with black abrasion-resistant Thermofit tubing. Flat VSWR across the band excellent performance. Includes trunk lid mount. Cable & PL 259 plug removed in seconds.
Frequency: 27 MHz. Only 48.5" high. Weight: 1.0 lbs. VSWR. Less than 1.5:1. **$29.50**

G **27MC GPV BASE LOADED VERTICAL GROUND PLANE ANTENNA**
A ruggedly constructed low-cost high performance vertically polarized, omni-directional base station antenna. It develops transmitting gain of 3.8 dB through pattern compression and a lowered angle of radiation along with improved signal-to-noise ratio. The matching stub places it at DC ground potential which substantially lowers the residual noise level and results in gains as high as 19 dB in signal-to-noise ratio.
Gain: 3.8 dB. VSWR: (At resonance) 1.25:1. Coaxial Feedline: 52 ohms. Omni-Directional Pattern Overall Height: 212 inch. Diameter of Radiator: 1-1/2 inch to 1-7/16 inch. Mast Bracket Accepts: Up to 1-5/8 inch. Weight 5.5 lbs. Full 1/2 Wave. **$49.50**

H **27MC 36 GROUND PLANE ANTENNA**
High efficiency Ground Plane Antenna for CB base station. All aluminium construction. Accepts PL-259 connector. Solid aluminium 108 inch heat-treated radials and radiator. Elements supplied in two 54 inch lengths joined by threaded coupling nuts. Radial droop for 50 ohm match. Accepts 1-1/4 inch tubing and PL-259 connector.
Frequency Range: 27 MHz. Impedance: 50 ohms. VSWR: Less than 1.5:1. Weight: 4.5 lbs. Wave: 1/4. **$35.00**

For enquiries send s.a.e. post and packing extra.



I **HAMS—DISCONE**
80 MHz TO 480 MHz
A highly efficient discone type antenna. All aluminium with 8 radials & 8 radiators. Accepts PL 259. Radials droop for 50 ohm match. Bracket to suit 1-1/4 tubing.
VSWR: Less than 1.5:1.
Gain: 3.4dB compared to 1/4 wave g. plane ant.
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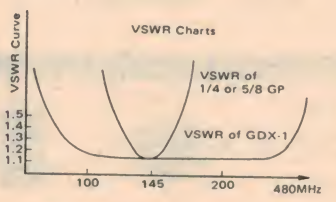

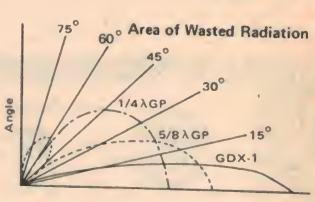

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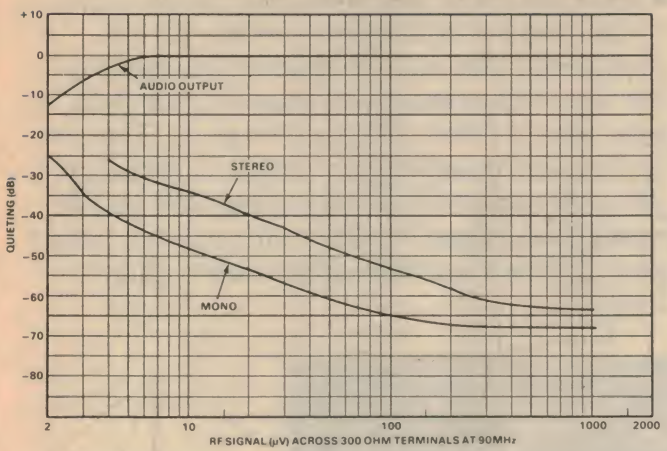
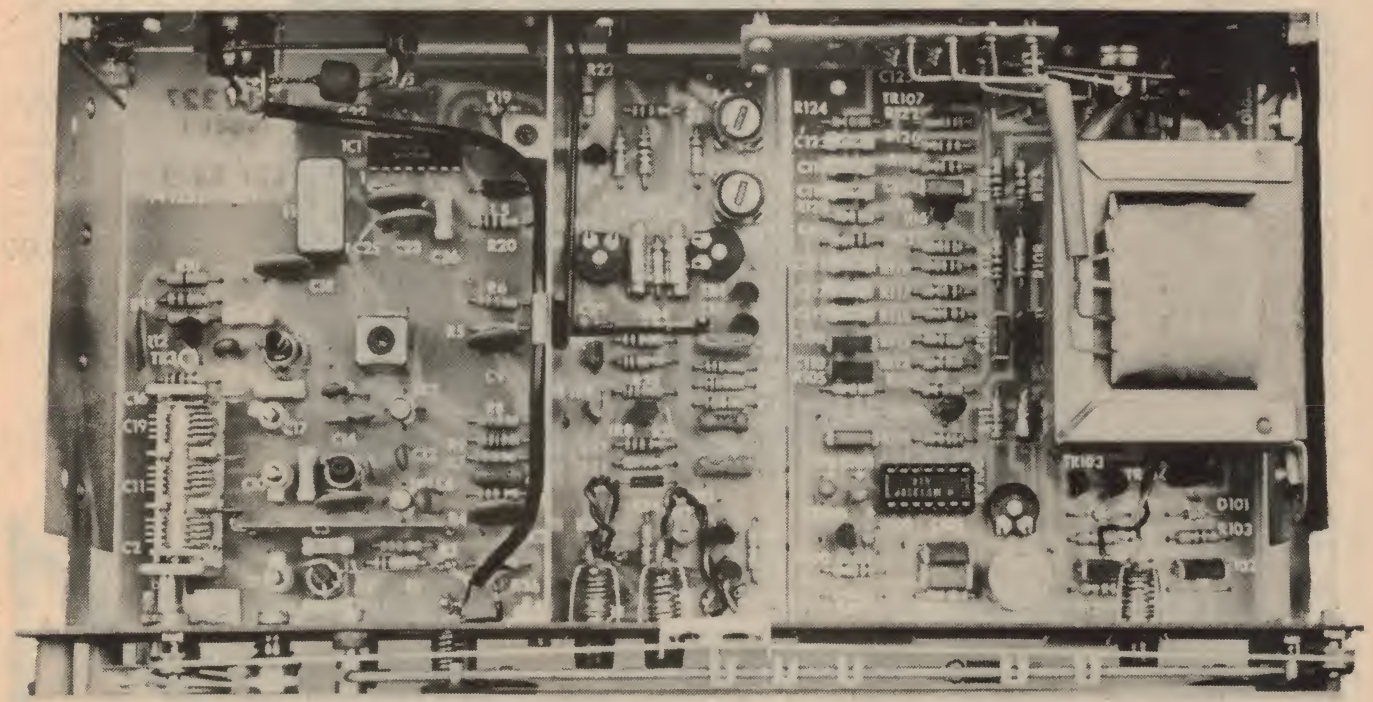


Curves showing quieting: output signal-to-noise ratio versus RF input signal, in both mono and stereo modes.

Frequency response in the mono mode (using the separate mono output) was 10Hz to 15kHz ±½dB and only 0.8dB down at 20kHz. Distortion ranged from 0.06% at 7.5kHz to 0.27% at 100Hz. Surprisingly distortion in the stereo mode was very little worse with the measurements all less than 0.3% and typically about 0.25%.

Frequency response in the stereo mode was within ±½dB from 10Hz to 12kHz and 2dB down at 15kHz. These frequency response figures were taken with the abovementioned filters out of circuit. Separation between channels checked out at 47dB at 100Hz and 1kHz and 31dB at 10kHz. These are excellent figures.

We should note at this stage that the tuner referred to in these tests has serial number 18094 and not 14581 which is shown in the photographs. The latter tuner was submitted for review but testing showed that it was malfunctioning and it was replaced by the distributors.



A relatively bulky transformer powers the Quad FM tuner. Neat layout is easy to service.

remove high frequency hash. De-emphasis is correct for Australia at 50 microseconds.

In use we found the Quad FM3 gave entirely satisfactory service. Our only complaint involves the appearance of the tuning indicators and the stereo beacon. These have little translucent windows through which they are supposed to shine—but since the normal viewing angle is from above the tuner, one can see the filaments through the transparent portion of the dial. This does not impair the operation, it just looks corny.

Many of the results of the performance testing are shown in the graph of the quieting curves. A look at the audio output curve shows that full limiting is achieved with an RF signal of 6uV. 30dB signal-to-noise ratio for a mono signal was achieved with an input of 2.5uV. Ultimate signal-to-noise ratio for mono was 68dB and for stereo 64dB.

Note that although we show the stereo curve beginning at a signal level of 3uV the stereo indicator actually lights up for signals as low as 1.5uV.

All tests in the stereo mode were made using filters to reject the residual 19kHz and 38kHz components. 19kHz output was 37dB down from full audio output while 38kHz output was 57dB down.

So far then, the performance figures are good but certainly not spectacular. Where the Quad does excel is in the results for frequency response, harmonic distortion and separation between channels. These results are for an input signal of 1 millivolt to the 300 ohm antenna terminals and refer to 100% modulation.

In summary, we can state that the Quad FM3 tuner is an eminently satisfactory performer which is notable for its low distortion, wide separation and flat frequency response. It should have special appeal to those who like gimmick free styling. It is a pity that import costs and duties make it so expensive. Recommended retail price is $331.65 including sales tax, insurance and freight to main centres.

Further information of the FM3 tuner and other equipment in the Quad range can be obtained from the Australian distributors, British Merchandising Pty Ltd, 49-51 York Street, Sydney, NSW 2000. (L.D.S.)

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Yamaha YP-450 Turntable

Yamaha now have a comprehensive range of high fidelity equipment spanning every price range. Here we review one of their lower-priced turntables, the Yamaha YP-450. It is a two-speed, belt-driven unit supplied without cartridge.

A recent trend in turntable design has dispensed with the steel or diecast base plate and separate timber platform and substituted a thick sandwich of compressed particle board. This material is quite dense and is dimensionally stable.

Whether or not this approach is cheaper we do not know, but it must be admitted that it allows a cleaner styling to be achieved. And it is definitely an improvement on some of the quite flimsy timber or plastic platforms we have seen.

On the YP-450 the timber platform is glued up from three layers of 15mm thick particle board which have been milled or routed to provide cavities for the motor, speed change mechanism, arm terminations and other hardware. A hardboard cover closes off access to the underside and the whole assembly is suspended on four compliant rubber feet to provide acoustic isolation from bench or shelf vibrations.

Partly as a result of the baseplate-cum-plinth construction, the styling of the YP-450 does seem particularly light and clean without being in any way flimsy. Helping that impression is the clear perspex cover which, in this reviewer's opinion, is an improvement on the dark tinted covers on some other turntables. Why should a turntable cover be so dark so that you cannot see whether it has a record on it or not? And anyway a dark perspex cover only makes the inevitable accumulation of dust more noticeable.

Another attractive feature of the cover is that it has spring-hinges which are friction-loaded to allow the cover to stay open in a number of positions and also prevent it from falling with a bang when it's lowered. A small point perhaps, but many turntable covers have quite unsatisfactory hinges. The cover is not removable.

Overall dimensions of the YP-450 are 440 x 153 x 389mm and mass is 9.4kg. Clearance required behind the hinges to allow the cover to open fully is about 60mm. A connecting lead about 1.2 metres long is provided and this is fitted with RCA phono plugs. The mains cord is a figure-8 flex and our sample was fitted with the non-approved American 2-pin plug.

Two simple controls are provided for operation of the turntable. These take the form of two levers on a small panel on the right-hand side of the player. One lever selects the speed of 33 or 45 rpm. The other switches the motor as well as providing the lift and lower function for the arm. Both lifting and lowering of the arm are viscously damped. Apart from this, operation is completely manual and there is no automatic cut-out or lift-off at the end of a record.

The thick-rimmed platter has a diameter of 300mm and is driven around an inner rim by the usual flat rubber belt from a synchronous motor via a stepped pulley. The curved tubular arm is balanced longitudinally by its rotatable counterweight, which also sets the vertical tracking force. Anti-skating is provided by a small dial at the base of the arm—we assume it is a spring mechanism.

The Yamaha YP-450 is a manual turntable with simple controls. It is supplied without cartridge.

No cartridge is supplied with the YP-450. The headshell has the standard EIA locking collar and colour-coded leads and will accept any cartridge with 12.7mm mounting centres. Slots are provided in the headshell to enable adjustment of the stylus overhang. Since the arm is to be used with a wide range of cartridges it is adjustable in height as is the lifting device. These adjustments are made by loosening off the appropriate Allen screws, and then making the setting.

Cable capacitance is less than 100pF so it is possible to use a CD-4 cartridge.

We found the adjustments for height of arm and lifting device quite fiddly, but the rest of the setting-up procedure was straightforward. Tracking force calibrations were within 5% of the mark and antiskating settings were close to optimum. The motor has plenty of torque and brings the platter up to speed within half a revolution. Main bearing friction is quite low—the platter took over 90 seconds to come to a halt from 33 rpm with the belt removed.

Bearing friction in the arm pivots is also very low, so low tracking forces can be employed with good quality cartridges.

We measured wow and flutter at 0.1% according to DIN 45507. This is the lowest result we have obtained on a belt-drive turntable to date. Very good.

Not so good was the rumble measurement. Yamaha quote it as 48dB without any qualification. We measured it 40dB with respect to 5cm/sec unweighted and with a 6dB/octave roll-off below 25Hz to simulate typical amplifier response. While the result may seem reasonable we felt that the component of motor noise alone (measured with belt removed) was too high at minus 48dB and could have been improved with a more compliant motor suspension. So if you have loudspeakers with very good low frequency response and are often wont to play them at high levels with bass boost, motor noise from the YP-450 could possibly be troublesome during quiet sections.

Aside from our comment about rumble the Yamaha YP-450 is a good performer especially with regard to its low wow and flutter. Recommended retail price of the YP-450 is $189 including sales tax.

Further information on the YP-450 and other products in the Yamaha range may be obtained from high fidelity retailers or from the Australian distributors, Rose Music Pty Ltd, 17-23 Market Street, South Melbourne, Victoria or interstate offices. (L.D.S.)

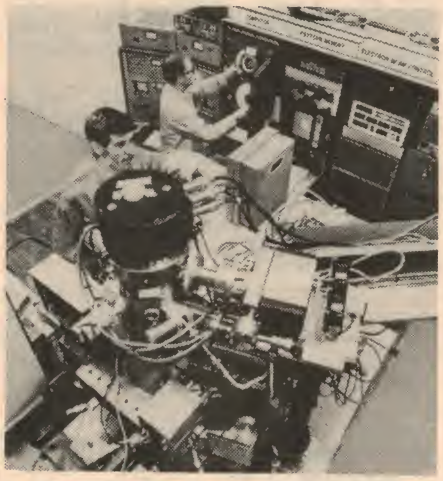
News Highlights

Electron beams speed integrated circuit manufacture

A major advance in the fabrication of integrated circuits has been achieved at Bell Telephone Laboratories by the development of an Electron Beam Exposure System, known as EBES. By using a beam of electrons to generate the microscopic patterns from which integrated circuits are manufactured, EBES can produce integrated circuit master pattern masks faster, more reliably, with fewer defects, and at lower cost than masks made by existing photographic systems.

"Integrated circuits are becoming more complex, more densely packed with devices, and larger every year," says Eugene Gordon, Director of the Pattern Generation Technology Laboratory at Bell Laboratories Murray Hill, New Jersey. "Pattern generation is one of the important limiting factors in integrated circuit technology," says Gordon, "but EBES now makes possible the routine production of master masks of a quality that was previously possible only at great expense."

The automated, computer-controlled EBES uses an electron beam to write the intricate, microscope integrated circuit patterns. Electron beams are superior to light beams used in conventional mask-making processes. This is because electrons have a smaller equivalent wavelength than light and a much "sharper" writing beam can be generated.



View showing the electron beam assembly and the process control computer.

Spot size of the EBES electron beam is only 20 millionths of an inch in diameter—about one-hundredth the width of a human hair. Even smaller spot sizes can be used, but with a corresponding increase in the time and hence the cost needed to produce the mask.

EBES writes its intricate pattern on a chromium-coated glass substrate covered with a film of chemical "resist" which is sensitive to the electron beam. The unexposed portions of the resist and the underlying chromium are then etched out by chemicals, leaving a negative mask pattern of chromium on glass.

The electron beam system can write the microscopic pattern of a single integrated circuit chip over a larger pattern area than conventional optical cameras. Main advantage here is a simplification of the mask-making process for very large chips, resulting in substantial cost savings.

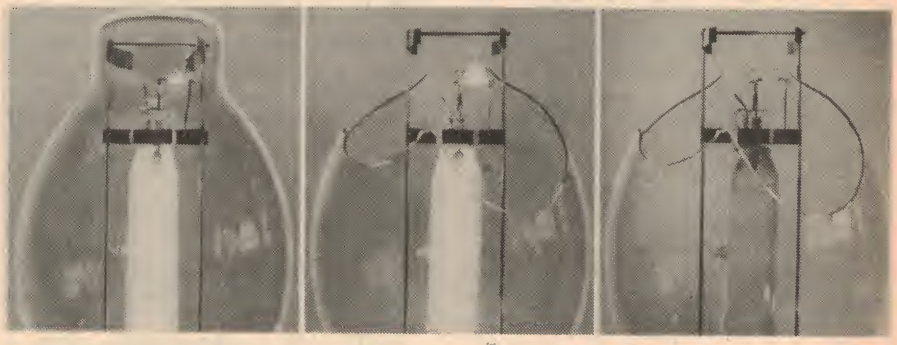
The EBES mask-writing operation is fully computer-controlled. Circuit design instructions are recorded on a magnetic tape and fed into the EBES computer which controls both the electron beam and the movable stage holding the mask blank. The stage, which has a positioning accuracy of a millionth of an inch, moves continuously whilst the pattern is being written. This results in a faster and more accurate exposure than if the stage stopped for each exposure, as do the sequential optical cameras presently used in the integrated circuit industry.

New mercury arc lamp burns out on cue

Most light bulbs burn out almost immediately after their outer glass shells are broken. But not all. High-intensity mercury vapour lamps, of the type commonly used for street lighting, sports arenas, gymnasiums, and parking areas, can burn brightly for 100 hours or more after their glass shells have been broken. In fact, it may not even be realised that the lamp is broken.

And therein lies the danger. The mercury vapour arc tube emits intense ultraviolet radiation that can be quite dangerous when the lamp's protective outer glass shell (which normally absorbs ultraviolet) is broken. Depending upon the light intensity, time of exposure and distance from the light source, serious burns to the eyes and skin can result.

In order to overcome this hazard a US firm, Duro-Test Corporation of North Bergen, New Jersey, has developed a new type of mercury vapour lamp. Designated the Safe-T-Vapor lamp, the new lamp incorporates a small tungsten filament wire in series with one of the electrodes at one end of the arc tube. If the outer glass shell is broken, the tungsten filament quickly oxidises and evaporates, breaking the circuit.



Laboratory testing has shown that the new lamps are extinguished within one minute (sometimes within 30 seconds) of a breakage. According to Duro-Test, they have been demonstrated to the US Bureau of Radiological Health (which first raised the safety issue), and are now in production.

Communications satellite for tracking, data relay

RCA Global Communications, Inc. has been awarded a $US1.8 million contract by the National Aeronautics and Space Administration (NASA) for the design of a new satellite communications system. The system, the Tracking and Data Relay Satellite System (TDRSS), will permit the space agency to use direct satellite-to-satellite communications in its daily operations.

RCA Globcom and the General Electric Company, Space Division, have signed a team agreement for the Phase I study. The companies will develop a detailed operation and construction plan for the system, including technical, cost and business proposals.

A unique feature of the TDRSS program is the provision for private ownership of the system. NASA will lease services from the system owner, making monthly payments based on usage when service begins.

TDRSS will supplement and largely replace NASA's present tracking system including 18 earth stations located around the world. This ring of stations is now required to maintain communications with spacecraft as they move around the earth. The TDRSS system also will provide telecommunications support for the space shuttle program.

Echo-free chamber for jet noise studies

One of the largest echo-free chambers in the world, recently completed at NASA's Lewis Research Center in Cleveland, is expected to increase the Center's capability in researching ways of reducing the piercing noise of jet airplanes.

Called the Engine Fan and Jet Noise Facility, it is the first all-weather indoor installation at Lewis able to test noise characteristics of quiet fans for advanced aircraft engines as well as perform evaluation tests on new ways to reduce the rumble of jet nozzles.

The facility is 52 feet wide, 56 feet long and 17 feet high. All surfaces of the $US900,000 facility are treated with anechoic (echo-free) 30-inch fibreglass wedges, which absorb sound. Nearly 20,000 cubic feet of fibreglass was used in constructing the wedges. Acoustic tests have shown that the facility can absorb essentially all sound in the region of interest for aircraft engine fan models up to 20 inches in diameter. Jet nozzles up to four inches in diameter also can be tested in the chamber.

The facility uses an existing control room which has been adapted for noise research. The control room is linked directly to the Center's central computer, permitting rapid analysis of much of the data.

Dr Lothar Rohde visits Aust.

. . . here for IREE convention

Dr Lothar Rohde

Dr Lothar Rohde recently visited Australia at the invitation of the Institute of Radio & Electronics Engineers and Kemtron Operations. Dr Rohde, who is co-founder of Rohde & Schwarz (a large West German electronics company), delivered a paper at the IREE Convention entitled "Planning an FM Network in Europe."

Regarded as the "father" of the FM network in West Germany, Dr Rohde was also responsible for planning the FM service in South Africa. While in Australia, he met senior personnel in the broadcasting industry and held talks with his Australian distributor, Jacoby Mitchell Ltd.

Dr Rohde last visited Australia in 1974 as an expert witness at the McLean Inquiry into FM broadcasting. Observers say that it was his submissions that drove the final nail into the UHF coffin, paving the way for an FM broadcasting service on VHF.

European Cos-B satellite will detect gamma rays

Recently launched atop a NASA rocket, the European COS-B satellite will detect and locate gamma rays in space—the most energetic and penetrating form of radiation known. The satellite was developed for the European Space Agency (ESA) by European industry, with a 25 percent share of the development program taken by the British Aircraft Corporation.

COS-B is an astronomical observatory which will enable scientists to study extra-terrestrial gamma radiation. The rays come from radioactive atoms and nuclear explosions or may be the remnants of exploding stars or quasars, pulsars and other radio and X-ray sources.

The satellite has a planned operational life of two years and will orbit every 37 hours, varying in distance from the Earth between 350km and 98,000km. Total weight at launch was 278kg.

CEMA to represent Motorola Semiconductors

CEMA Distributors Pty Ltd has announced appointment as a franchised distributor for Motorola Semiconductor products throughout Australia. The agreement, effective from November 1st, 1975, was signed by the General Manager of CEMA Distributors, Mr Ray Adams.

The agreement with Motorola follows the take-over of CEMA by J. S. H. International Inc, a large components distributor in the US. Bryen Tanner will lead Motorola products marketing.

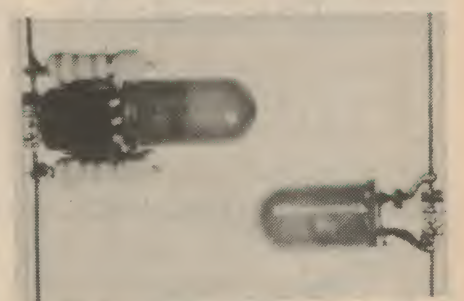
Cheap microwave leak detectors

The CSIRO National Measurement Laboratory, Sydney University, has developed several cheap microwave detectors intended for checking microwave ovens. Microwave ovens may leak dangerous amounts of radiation due to deterioration after long use or after being damaged. Such leakage, for example, could cause permanent eye injury after prolonged exposure.

In one of the detectors developed, a small lamp bulb is the major component. When connected to an aerial—two short lengths of wire—the globe glows brightly when it encounters power levels of 5 milliwatts per square centimetre, a figure generally accepted as the maximum safe level.

The globe itself differs from ordinary torch bulbs in that it uses a special low-inductance filament, achieved by winding the filament into a helix of very small radius. This allows sufficient current to flow to light the lamp at low power levels.

In a second type of leakage detector, the aerial is connected to a hot-carrier



diode which causes a LED to glow whenever power leakage is detected. However, this device and the one mentioned previously, will also produce a dull glow at power levels below the maximum safe level. To avoid confusion, therefore, two additional monitors have been designed in which the light switches on abruptly whenever the safe level of radiation is exceeded.

All these detectors are very cheap to build, the components costing between 60 cents and 2 dollars. They are intended for both domestic and commercial oven users and should answer the needs of technicians who install and service microwave ovens but cannot afford existing radiation monitors costing over $1,000.

LOGIC DESIGNERS

For less money, you can now design 2mW per gate digital systems that operate at twice the speed possible using standard TTL.

With Fairchild 9LS low power Schottky TTL circuits, logic designers can now create 2mW-per-gate digital systems that operate at twice the speed possible using standard speed TTL devices. System design is simplified because of low power requirements, reduced heating and low noise operation. This new TTL family operates at gate delays of only 5 ns typical, 10 ns worst case, which is twice the speed of standard 54/74 or 54LS/74LS low power Schottky TTL devices.

The speed/power performance allows the 9LS circuits to replace standard TTL, high speed TTL, low power Schottky (including 54LS/74LS) and some standard Schottky TTL parts with a power savings of 500 to 1000%.

The economies of 9LS do not end with component cost. Figures 1 & 2 illustrate the greater ac stability of 9LS with temperature and loading.

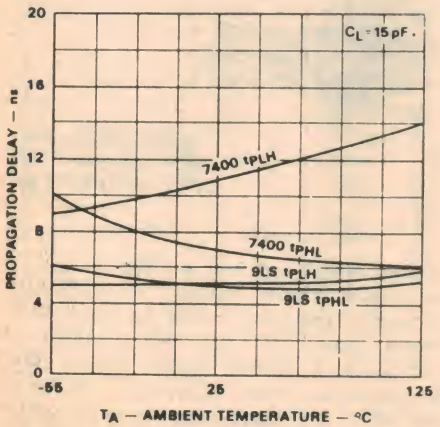


Figure 1

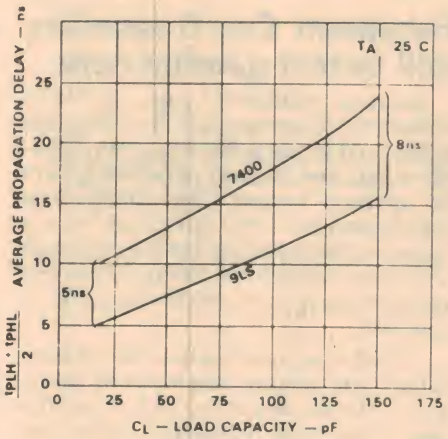


Figure 2

This translates into easier design and fewer problems in the field. The fan-out of LS is 20 into other LS circuits, which means fewer added components for buffers. Schottky gates, used as clock or bus drivers have fanouts of 50 into LS resulting in component savings as well as fewer clock skew problems. LS is fully compatible with Fairchild 34000, RCA 4000B or National 74C CMOS. It can go to and from CMOS without external components. Interface with other MOS devices are also simplified; MOS typically exhibits a fanout of four LS loads.

- **Low Power** — Next to CMOS the lowest of any modern logic family. In fact, it's lower than CMOS at frequencies of 2 MHz and above.
- **Low cost** — Apart from saving on components, Fairchild 9LS in most instances costs less than standard TTL.
- **High Performance** — the best speed this side of standard Schottky. It's faster than H series at 1/10 the power.
- **Good Temperature performance** — The ac characteristics of our 9LS/54LS are extremely stable with temperature.
- **High Capacitance Drive Capability** — Actually superior to standard power TTL.
- **Compatibility** — 9LS/54LS is directly compatible with all TTL families and modern CMOS families such as 34000, CD4000B and 74C. Fairchild 9LS meets all 54LS/74LS for second sourcing.

Fairchild 9LS

9LS00	Quad 2-Input NAND Gate
9LS02	Quad 2-NOR Gate
9LS03	Quad 2-NAND Gate (O/C)
9LS04	Hex Inverter
9LS05	Hex Inverter (O/C)
9LS10	Triple 3-NAND Gate
9LS11	Triple 3-NAND Gate (O/C)
9LS15	Triple 3—AND Gate (O/C)
9LS20	Dual 4-NAND Gate
9LS22	Dual 4-NAND Gate (O/C)
9LS32	Quad 2-OR Gate
9LS51	Dual AND-OR Invert Gate
9LS74	Dual D Flip-Flop
9LS86	Quad Exclusive OR Gate
9LS109	Dual JK Edge Trigg. Flip-Flop
9LS112	Dual JK Edge Trigg. Flip-Flop
9LS113	Dual Edge Trigg. Flip-Flop
9LS114	Dual JK Edge Trigg. Flip-Flop
9LS136	Quad Exclusive OR (O/C)

And 9LS/MSI

9LS138	1-of-8 Dec/Demultiplexer
9LS153	Dual 4-Input Multiplexer
9LS174	Hex D Flip-Flop W/Clear
9LS175	Quad D Flip-Flop W/Clear
9LS196	Decade Counter
9LS197	4-Bit Binary Counter
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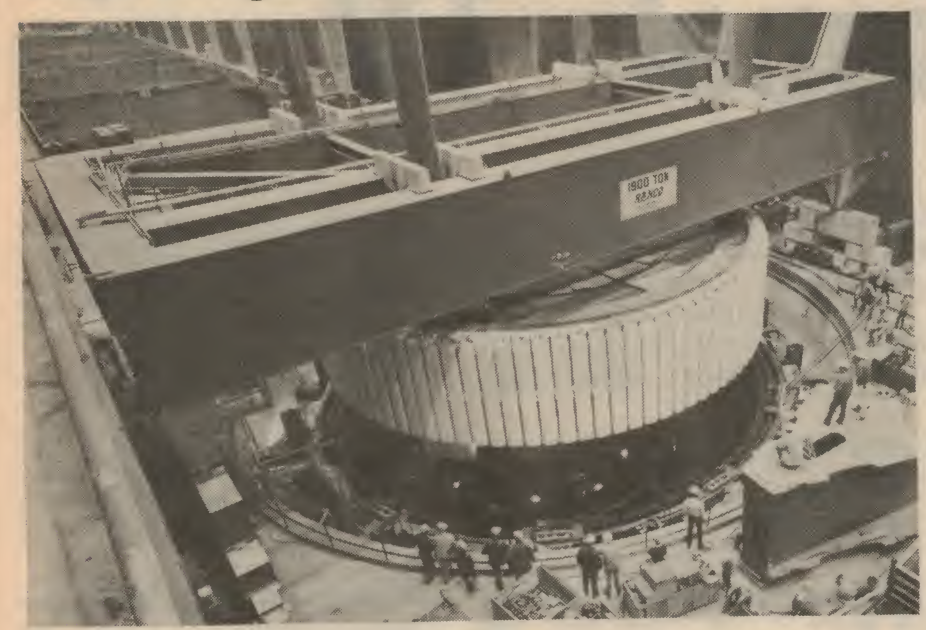
NEWS HIGHLIGHTS

World's largest hydro-electric generator



Workmen look on as the 1,800 ton rotor for the world's largest hydro-electric generator is lowered onto the 8ft diameter shaft that will connect it to the hydro-turbine. A specially designed crane was required to move the 60ft diameter rotor from its assembly area nearly ¼ mile away. Scheduled for operation last August, the generator is the first of three 600,000kW units to be built by Westinghouse Electric Corporation in East Pittsburgh for a Bureau of Reclamation power plant at Grand Coulee Dam, Washington state.

Another video disc system . . . this one from Hitachi

With one video disc system already on the market in Europe, and the two principal contenders in the video disc stakes, Philips/MCA and RCA, ready to do battle in the US, the Japanese company Hitachi has suddenly got into the act with a system of its own. The new system, developed at Hitachi's Central Research Laboratory in Tokyo, uses an optical holographic approach and is said to provide 30 minutes of colour television from a 30cm disc.

The disc contains 54,000 holograms, each storing luminance, chrominance and sound information superimposed in an area that's only 1mm in diameter. This storage density is so high, that the speed of revolution required is only 6rpm. The two other optical video disc systems, one developed by Philips and MCA Dico-Vision and the other by Zenith Radio Corporation and Thomson CSF, use 1,800 revolutions per minute. Same goes for the RCA system, which uses capacitative pickup.

Hitachi has yet to announce whether it will market the system. However, at first sight it appears to be a promising new contender because of the low speed revolution required. This could greatly reduce the cost and complexity (if not eliminate) the expensive servo systems used in previous video players. The light source used is presumably a low-power laser.

Australia's first general purpose mini

The first free-standing, commercially available general purpose minicomputer to be designed and manufactured in Australia has recently been announced by Computer Manufacturers (Australia) Pty Ltd of Sydney. According to CM(A) . . . "Australia can no longer afford to be completely dependent on overseas technological sources for all the necessary elements of data communication and information processing systems."

Designated the CM-202, the Australian mini is said to compare favourably on a price/performance basis with major imported alternatives. Technically, it is claimed to satisfy Australian Government requirements (as expressed in current Australian Government tender specifications for minicomputers for the period 1975 to 1980) in terms of storage capacity and expandability, processing speed, and the ability to operate with all accepted forms of input and output devices.

In hardware terms, the CM-202 is a general purpose 16-bit digital computer with memory expandable in 16k word increments to a maximum to 64k words. Standard processor features include double precision arithmetic, hardware multiply/divide, memory and DMA channel polarity, direct memory access channels, and a vectored priority interrupt system. The basic chassis contains the central processing unit (CPU) together with up to 32k words of memory, three integral peripheral controllers and three spare I/O slots.

CM(A)'s Charles Amy with the new mini.

A full range of peripheral and control equipment is available with the CM-202. These include fixed and moving disc heads, tape units (including cassette), communications line controllers, VDUs, printers, paper tape equipment, console teletypewriters and analog to digital converters.

Wentworth Hotel installs cable TV system

Receiving a good colour TV signal amongst the high rise buildings of central Sydney poses many problems. In the case of an international standard hotel, where guests expect the best, a good reception is especially important.

The Wentworth Hotel, faced with reflective problems from certain nearby office blocks, last year commissioned AWA Rediffusion Pty Ltd to carry out a survey on colour TV reception problems.

As a result, the hotel has recently installed AWA 18" colour TV sets in every one of its 400 plus rooms as well as its own cable TV system fed from a series of specially installed highly directional TV aerials on the hotel roof. The system pipes colour TV to every guest suite and can be readily adapted to supply an additional closed circuit channel for entertainment or conference requirements.

The sets and the system were supplied and installed by AWA Rediffusion Pty Ltd—a specialist cable TV joint venture company formed by two of Australia's and Europe's largest communications companies, Amalgamated Wireless (Australasia) Limited and Rediffusion Limited.

India's schoolroom in the sky . . .

Educational TV via

India's long-awaited Satellite Instructional Television Experiment got underway last August, with programs beamed up to a NASA satellite and relayed back direct to some 2,400 villages. Though much of the programming is educational, India is the first country to distribute TV to its backward hinterland before providing a service for many of its big cities. What the social impact will be is, at this stage, unpredictable.

by BRENDA MADDOX

The need for anticipating the social impact of new methods of communicating has never been so great—and neither has the temptation to label any kind of communications project an "experiment." Last week, India began its long-awaited Satellite Instructional Television Experiment (SITE). Its objectives are pretty diffuse: "to gain experience in managing a satellite-based educational television system in rural areas; to stimulate national development; and to demonstrate the potential value of satellite technology in the rapid development of effective mass communications in developing countries." There is also the more specific goal of trying to teach—via satellite—birth control, agriculture, education and nutrition, as well as to train teachers.

For one year the Indian Space Research Organisation (ISRO) will use the National Aeronautics and Space Administration's ATS-6 satellite to beam television direct into 2,400 isolated villages. About an equal number of villages will receive the television programs by conventional relay from satellite receiving stations in Ahmedabad, Delhi and Amritsar.

The ATS-6 is claimed to be the world's largest communications satellite. Launched last year, it has a 30ft parabolic antenna and 470 watts of power. NASA is making no charge for lending the satellite, which itself cost $US200 million, but the entire cost of the project on the ground—from equipping the villages for direct reception to making the instructional programs—is being borne by India. It is estimated at about £6 million.

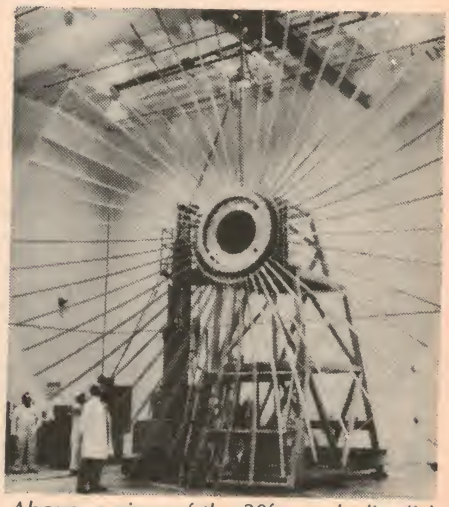
The excitement which SITE, even in gestation, has stirred up internationally concerns the direct reception from the satellite. Each participating village has received a 10ft antenna made of chicken mesh, and a 24 inch solid state television set which has been "augmented" by a front-end converter. The antenna is connected to the set by a 50ft cable.

For villages where there is no electricity the equipment also includes a set of two 12-volt heavy duty batteries. Most of the villages in SITE have been given a simple form of electrification, usually a line run from the agricultural electricity supply in the fields outside the village, in order to power the set.

With no more than this hardware, costing in all perhaps £350, the village can tune into the satellite, even though it may have been untouched by any other form of modern technology, except the transistor radio and the jeep which brought the SITE installation team.

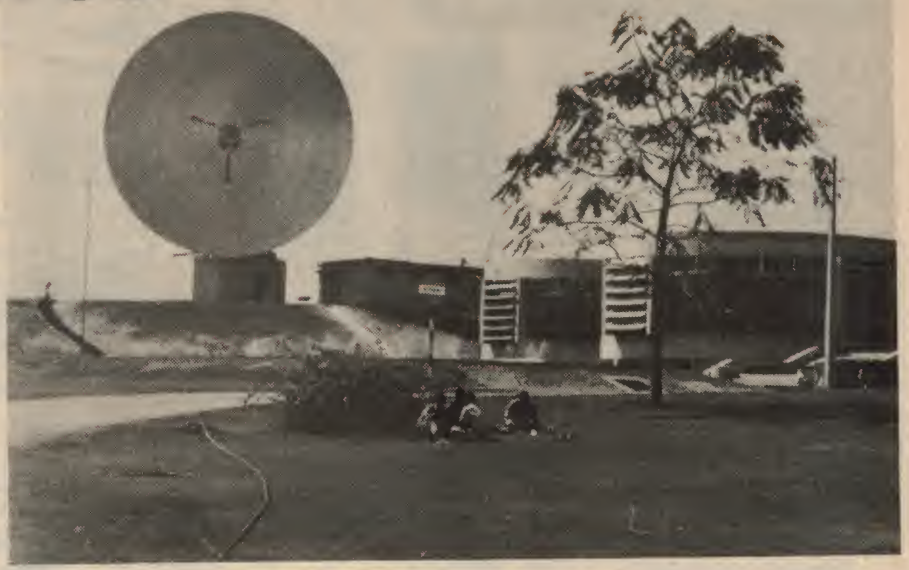
The villages chosen for SITE lie in six clusters in the states of Radjasthan, Bihar, Orissa, Madhya Pradesh, Andrha Pradesh and Karnatka. Each cluster has a headquarters which has the responsibility for keeping all the sets in running order. There are four jeeps assigned to each cluster, each jeep providing service for 100 villages.

In each village a custodian has been hired to look after the television set, to switch it on and off, and to count the size



Above: a view of the 30ft parabolic dish antenna as used on NASA's ATS-6 satellite. At left is a line of 10ft antennas, shown here at Ahmedabad headquarters, of the type used at each participating village.

a satellite



View showing the prime Earth station at Ahmedabad which will transmit signals to the satellite for Project SITE. Great stress in the SITE programming has been placed on indigenous culture, both for entertainment and for instruction.

of the audience at each viewing session. If the set breaks down, he checks the faults illustrated on a postcard (no sound, no picture, neither sound nor picture, or a conspicuous electrical power failure) and posts it to the cluster headquarters. (Thus the successful performance of the world's largest communications satellite depends on the efficiency of the Indian postal service.)

Every day in the early evening, each village will get a television program in its own language made up of local news, entertainment and instruction. All-India Radio, which has prepared the program material, has tried to use only indigenous ingredients: folk music, local storytellers and ballad singers for the entertainment, farmers and housewives with their ordinary appliances and tools for the instruction. The lessons are simple and informal—how to prevent rickets in babies by feeding them solid food, how to measure with the knuckles how far apart the rice plants should go, how to make a little superphosphate go a long way.

After its local program, the village will get a half hour program from Delhi. It will carry national news and be in standard Hindi. Then the villages will be able to watch the programs directed at villages in another cluster, whose language they may be able to understand. In the mornings, there will be special programs for children in schools.

Professor E. V. Chitnis, manager of SITE, calmly anticipates the obvious question from critics. "Many people ask us whether it would be better to provide tube wells and drinking water instead of TV sets," he says. "However, what one is attempting to do through SITE is not to give TV sets to villages, but to make people self-reliant and to get them new information which will enable them to do something worthwhile for themselves—to learn to work together and acquire new skills, including those required for digging wells."

One of the fascinations of SITE is that India has so little television of any sort. There has been a television service, by All-india Radio, in Delhi for about 12 years, and two years ago it was extended to Bombay. The service has also been made available in the northern cities of Srinagar and Amritsar, where people were buying television sets in order to watch television "wafting" in from Pakistan. But Calcutta and Madras are still without a television service. What SITE is doing is to bring television to about 2.5 million people in the hinterland before the major metropolitan populations enjoy it, or before a full urban television service has been developed. India is probably the first country in the world to be able to introduce television in this way.

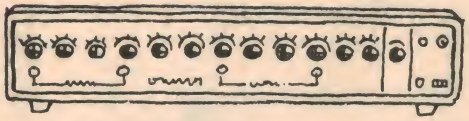
For its part, NASA is keeping a very low profile in Ahmedabad where SITE's headquarters are. Yet the relationship between the two space agencies is close and friendly. NASA's people tell with astonishment about watching Indian engineers from Project SITE set up an antenna when they went on a training visit to Goddard Space Center in the United States. They acted as if they were in India, a NASA man said. They dug a hole in the ground, got the Sun angle, the time of day, a fix on true north—and set up the antenna. "It was pointed exactly at the satellite," the NASA man said admiringly. "We couldn't improve on the position at all." NASA could never operate like that . "We'd have to dig a three foot trench and line it with concrete first," said the US official.

The very existence of Project SITE is evidence of the close relationship between NASA and the late Dr Vikram Sarabhai, who was head of the Indian Atomic Energy Agency in the 1960s (which then included space activities). NASA recognised that its then projected ATS-6 satellite would have a broadcast capability and Sarabhai recognised that India, with its million scattered villages could well utilise satellite broadcasting as a means of ending village isolation.

The decision to go ahead with Project SITE was made formal in a memorandum of understanding between the United States and India in 1969. SITE was to have begun in 1973, but the launching of the ATS-6 was delayed because of budgetary troubles on NASA's side. The Indians were grateful for the delay because organising the project, getting the hardware, recruiting the staff and cutting through the bureaucratic tangle at local, state and national levels of government was a formidable job—quite apart from the difficulties of preparing something to be shown on the television screens.

Then, in late 1971, Sarabhai suddenly died. His place as head of the Indian Space Applications Centre at Ahmedabad (the home city of the distinguished Sarabhai family) was taken by Professor Yash Pal, a theoretical physicist from the Tat Institute in Bombay. According to NASA officials, Pal is extremely impressive, and it is reckoned to have been his leadership that enabled SITE—against many bets—to begin on time.

SAVE ON OUR STOCK CLEARANCE

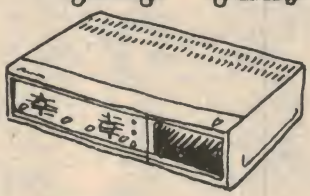


1. 100 Watt Clubsound P.A. System consisting 100 W Amp with 4 inputs separate bass and treble control on each channel—built in reverberation—plus 2 sound columns each containing 3 wide range 12 inch speakers.

***$575.00**

2. 120 W P.A. Amplifier 2 input separate bass and treble controls on each channel overload protected Type LBH 1010.

***$230.00**

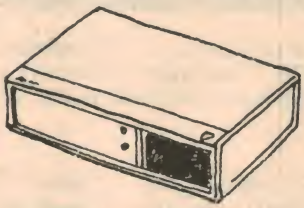


3. 60 W Power amplifier ideal for extending a system Type LBH 1007 (same cabinet as LBH 1010).

***$126.50**

4. 60 W P.A. Amplifier 2 inputs separate bass and treble controls on each channel overload protected Type LBH 1008.

***$184.00**

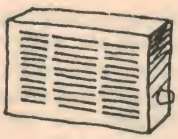


5. EV 4572 Sound column speaker containing 4 wide range 8 inch speakers power 20 Watts.

***$103.50**

6. VN 1110/00S Wall mounting speaker enclosure containing 8 inch twin coned speaker and tapped transformer.

$29.00



7. HR 3 Super Tweeter 35 Watts, Frequency 2 kHz to 17.5 kHz.

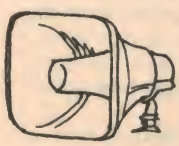
$50.00

8. APC 30T Wide Angle 30 Watt Reflex Horn with Driver and tapped transformer.

***$92.00**

9. AP 30T 30 Watt Reflex Horn complete with driver and tapped transformer—screw driver adjustment.

***$62.00**

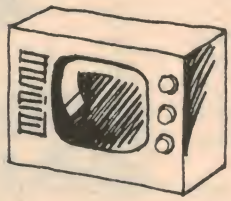


10. WR10T 10 Watt Horn suitable for music complete with tapped transformers.

$44.00

11. EV 4707 10 Channel intercommunication master station with all-call facility.

$115.00

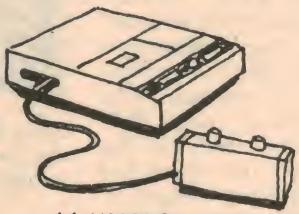


12. EV 4708 Remote Station for above.

$13.50

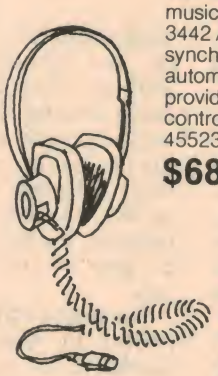
13. PYE LDM 0826/07—22 inch PAL colour monitors video and audio input (No R. F. front end). Cabinet may need touch up. Price does not include insurance or freight. Both payable to carrier.

$500.00



14. N2209 Cassette recorder suitable for music, dictation etc, supplied with LFD 3442 Adaptor which provides capability to synchronise cassette sound to most automatic slide projectors (those which are provided with a connection for remote control in accordance with DIN Standard 45523.

$68.85 complete



15. LCH 0007/01 Stereo dynamic headphones 30 Hz to 20 kHz 600 OHM (300 OHM Parallel) feather-light shock resistant, intended for high quality monitoring of speech or music. Mono to stereo change effected by altering contact connections in 6 Pin plug.

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PHILIPS

Educational TV

Though SITE's overall objectives may turn out to be unassessable, the project has nevertheless been organised so that some measurements on the impact of television on village life can be made. There is, for instance, a social science team, including nine anthropologists, and teams of researchers who will either live in or visit the villages participating in the project. They have already conducted censuses in the villages to find out what the beliefs and practices on matters such as family planning and agriculture were, and also to ask the villagers what they thought they needed in the way of help.

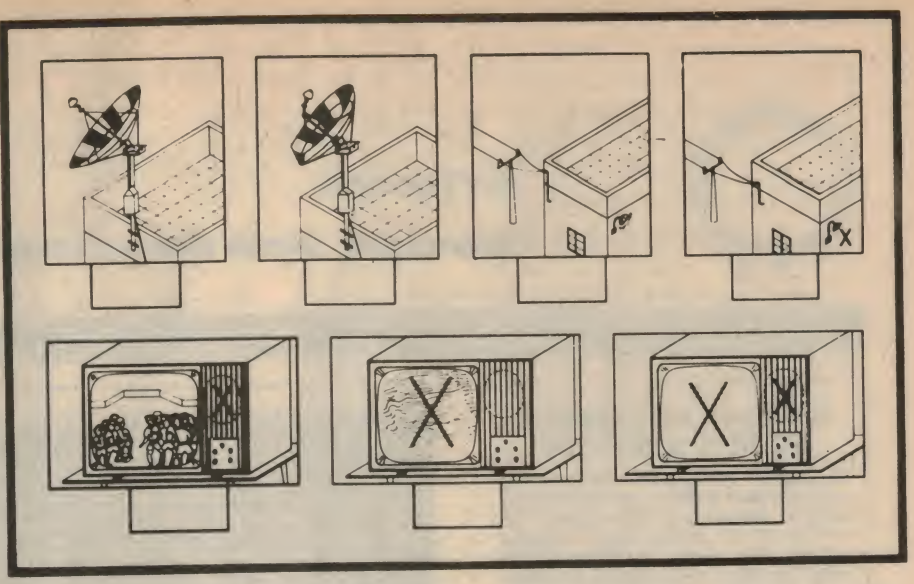
The social scientists have posed some interesting questions for themselves. These include the primary one that everyone will want to know when the year is up: did television actually teach? Other questions to be answered include: how has television changed the channels of communication in the village; do small social groups of, say, teenagers or old men still meet in the same way; have their times of meeting altered to accommodate the evening television viewing? Individual research scientists will also conduct in-depth studies on the changes wrought by television on village leadership patterns. Will the custodians of the TV sets become leaders? Is the change in social behaviour (if any) that follows the introduction of television a function of social class?

One charge that can be levelled against SITE is that its research is result-oriented. They are looking for something called "change" and will probably find it. But what brought change about? It is possible that the villagers may learn to be less fatalistic about their environment —perhaps not as a result of what they see on the television screen, but from watching a repairman mend the set. Another change is that the school broadcasts will be aimed at too wide an age span (five to eight year olds, nine to eleven year olds) and that there will be too many children in the room (150 is not impossible) for the television to be heard.

It is a great pity that SITE, so long in preparation, should follow close on the heels of the imposition of press censorship in India. For years critics of satellite broadcasting direct to rural populations have argued that it would merely put an instrument of control in the hands of a government trying for a single-party state. Their arguments now have some justification. The daily half hour news from Delhi will, in the light of recent events, be even more stilted than it would otherwise have been.

Those connected with SITE tend to feel that it has succeeded already, simply by becoming a reality. To have managed to get the hardware into 2,400 villages in time for the arrival of the satellite (now stationed at longitude 35°E) before the monsoon rains was no small feat. What mistakes have been made in programming can be corrected in years to come, for the villages chosen for SITE are also reachable by terrestrial microwave.

In any event, like Brazil and Indonesia India is committed to going to a full national satellite system. In India there is no question of building a full internal microwave network: satellites are going to be used, and what the Indians themselves are asking for from SITE is not so much experimental results but simply experience.



In order to get a repairman when the village TV set does not work, the village custodian checks the appropriate boxes on a postcard. These show, left to right top row: antenna OK, antenna damaged, power supply OK, power supply damaged; bottom row, left to right: no sound, no picture, no sound and no picture.

*Brenda Maddox is a freelance journalist and author. This article first appeared in "New Scientist," and is reprinted by arrangement.

Arlunya

Design And Development Aids

CIRCUIT DESIGNERS POWER SUPPLIES

Our design engineers needed multiple output power supplies to feed supply rails in breadboard hook ups or on printed circuit boards being operated out of their parent equipment. We could not buy cost effective commercial units, so we made them ourselves. Soon customers were pressing us to build some for them. As a result we put PS101 and PS105 into production.

FEATURES:

- Low cost — straightforward design
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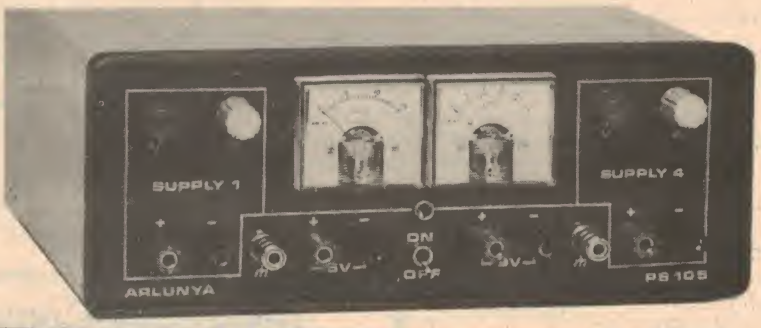
- Limited voltage range on fixed outputs minimises chance of costly setting up errors or accidental switching in of high voltages
- Cost effective: avoids tying up expensive wide range bulky lab. supplies on most straightforward rail voltage applications
- Ideal for general bench use in development labs, service workshops and educational institutions.



EXPERIMENTAL CHASSIS EC10

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Our design engineers wanted a reliable means of breadboarding without the limitations of most matrix type boards or the costly alternative of producing special to purpose P.C.B.'s for initial hookups. We could not find any suitable product that was commercially available so we designed and built our own.

The basic EC10 is a large (310mm x 250mm) high quality fibre glass printed circuit board which mounts on a heavy gauge anodised main chassis.

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IN LINE I.C. SOCKETS I.C. sockets mounted on the underside of the board to allow interference-free mounting of discrete circuit components on the top of the board.

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New machine for the blind

. . . for reading, writing and arithmetic

Electronics is often represented as an austere discipline, concerned only with profit making and remote from the problems of the individual. However, there is probably no other technology that will do more for the physically handicapped in the immediate future than electronics. Electronics is very much concerned with the "people business," as this story shows.

Life for the blind may be considerably improved in the future, thanks to developing electronic technology. In recent years a number of important new inventions have made an appearance, and these range from ultrasonic and microwave guidance devices to machines that facilitate the handling and manipulation of data.

In France, an ingenious new machine has been developed and was presented for the first time at the International Congress for the 150th Anniversary of the Invention of the Braille System, held at UNESCO headquarters in Paris last May.

The Digicassette, as the machine is known, will make it a lot easier for the blind to read and write, and to perform complex calculations. Interestingly enough, it was developed by a team of blind inventors working for the Valentin Hauy Association in Paris. Mr Schneider-Manoury, one of the inventors and Secretary-General of the Association, demonstrated how the machine works.

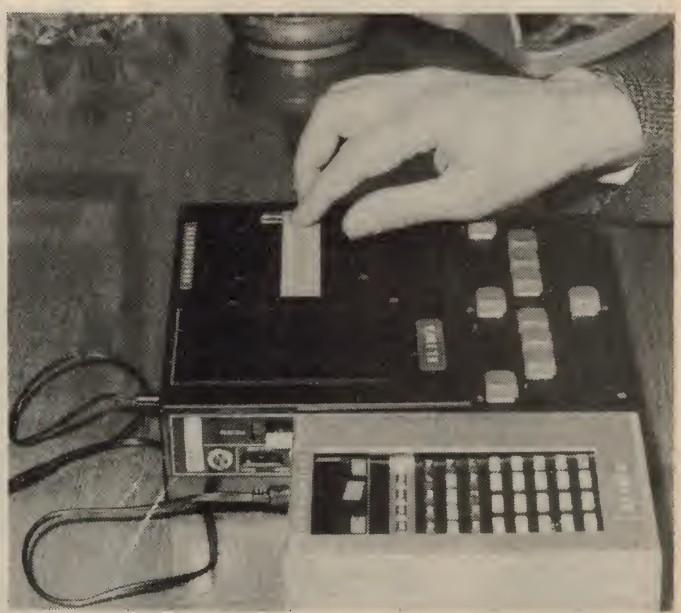
In appearance, the Digicassette looks like a small cassette recorder and, indeed, retains the essential functions of a tape recorder. Data is entered into the machine by means of a keyboard equipped with ten keys, and recorded on magnetic tape. A Braille readout panel consisting of some twelve characters is used to display data, either as it is written or read off the tape.

In fact the Braille readout panel is the key to the whole system, although technical details to hand on its workings are quite sketchy. However, it would appear that as data is read off the magnetic tape it is fed to suitable encoding circuitry. This, in turn, drives a number of solenoids which raise pins in Braille formation on the data panel. A technique similar to this was developed at the Electronics Division of the School of Mathematics and Earth Sciences, Macquarie University, for adapting electronic calculators to Braille readout.

The main advantage of the Digicassette system is its versatility, and the ease with which data may be entered, updated, and re-called. The cassettes used to store the data are the same as those used in conventional audio cassette recorders, and can store up to 150,000 Braille characters. Space requirements are thus drastically reduced and ease of handling considerably improved with this format, as compared to the conventional Braille texts.

In addition to its reading and writing capabilities, the Digicassette can be interfaced with an electronic calculator. Set up in this manner, data readout from the calculator can be reproduced in Braille. This is obviously an important extension of the machine's capabilities, and places the computing power of the modern electronic calculator within reach of the blind.

One area where the Digicassette format will obviously be of tremendous value is in providing new employment opportunities for the blind, and in teaching applications. The machine will increase the level of self-reliance and independence enjoyed by blind people and, as such, has considerable social merit. Current plans call for the Digicassette to be mass produced in the near future.



At left, Mr Schneider-Manoury demonstrates the Digicassette system. View at top clearly shows the Braille readout panel, and the calculator adapted for use with the Digicassette.

Computer system monitors racing car performance

Winning races like the Indianapolis 500 in the future will require a combination of several important factors: a skilled professional driver, a good pit crew, a carefully prepared racing car and—by the way things are shaping up—a computer! Team McLaren, one of the world's most successful automobile racing teams, are already using a computer for pre-race tuning and in-race performance monitoring of their cars.

The modern racing car has changed dramatically in recent years. Engines have changed, suspensions have changed, and the aerodynamic shape has changed. But one thing remains the same—the meticulous pre-race preparation that must be carried out on a car in order to ensure the reliability that wins races.

In the fiercely competitive world of motor racing, therefore, any one factor that will help improve reliability and perhaps provide some sort of "edge" is welcome.

In the case of Team McLaren, this "edge" is a small computer tucked in a corner of the pit area. The computer, a Nova 2 made by Data General Corporation of Southboro, Massachusetts, USA, is used for real-time performance monitoring of the Gatorade-McLaren USAC racing car.

Performance monitoring is achieved by the use of sensors in the car's engine while other sensors are used to monitor vehicle handling characteristics. A small telemetry transmitter in the car receives data from the sensors in the form of electrical impulses, multiplexes the data into a common communications channel, and transmits it to a receiver in the pit area. The data is then fed into the computer for processing.

At right, racing driver Johnny Rutherford at the wheel of the Gatorade-McLaren USAC racing car. (Photo Roger L. Smith, USA.) View below shows the computerised monitoring system mounted in Team McLaren's engine test area.

"The car has 14 of its functions monitored", said Mr Tyler Alexander, Team McLaren's Director of Engineering.

"The computer monitors the ride height of each of the four wheels, the forward and sideward acceleration, the oil and water temperature, oil and water pressure, air inlet temperature, engine RPM, turbocharger airflow, and fuel flow," Mr Alexander said. Some of these measurements are used for pre-race preparations, while others are used for real-time performance monitoring during the race.

Readings such as wheel riding height and forward and lateral acceleration are of primary importance during pre-race tuning. During practice runs the driver's reactions, together with the data provided, can be used to make suspension and airfoil adjustments to provide a car whose handling meets the requirements

of the driver and the track.

Of particular importance is the fact that the computerised system can keep track of fuel consumption as the race progresses. This is obviously a vital factor in overall race strategy and, according to Mr Alexander, "there previously was no way to measure the amount of fuel in the car."

This is because the fuel cells in racing cars contain a sponge-like safety material that prevents the fuel content from being monitored. During a race, therefore, it was previously possible only to estimate the amount of fuel left at any given stage. These estimates were made on the basis of previous performance.

To overcome this problem a small, propeller-like flowmeter inserted in the fuel line now monitors the amount of fuel that goes into the engine. Flowmeter revolutions are monitored by a sensor and the information relayed to the computer which calculates the fuel consumption. "This will avoid calling a car in for an unnecessary refuelling, or prevent a car from running out of fuel because its consumption was higher than estimated," Mr Alexander said.

As mentioned above, several readings will be useful mainly for real-time performance monitoring during a race. For example, although acceleration figures are primarily used for pre-race tuning, an increase in lateral acceleration during the race could mean that the tyres are not adhering to the track as well as they should. Race strategy would then dictate that the tyres be changed during the next pit stop.

"Oil temperature is another measurement that can play a role in determining race strategy," Mr Alexander said. "If we see the oil temperature rising it could mean increased friction in the engine, which is an indication that a part is failing. Depending on the degree of increase, the position of the car, and how far along the race is, we can tell the driver to continue at full speed, slow down enough to maintain his position, or call him into the pits before the engine is damaged."

The computer also counts the number of laps the car has made by counting the number of signal peaks as the car goes by. In addition, the lap time is calculated by counting the interval between signal peaks.

Information calculated by the computer can be displayed either on a video display unit, or can be printed out at a teletype terminal to provide a permanent record. The information displayed on the VDU can never be more than one second old.

In addition to supplying the computer, video display unit, and the teletypewriter, Data General Corporation wrote the programs that transform the telemetry data into standard units of measurements, and which make all necessary calculations. The 14-channel data acquisition and telemetry system was supplied by EMR-Telemetry, Florida, USA.

Protect your loudspeakers against damage with a

Loudspeaker Protector

It may look ugly, but it can save money!

Ever had the misfortune to "blow" an output transistor in an amplifier without coupling capacitors? Blow your loudspeakers too? you can guard against this possibility by building the Protector circuit described here. It also eliminates switch-on "thumps" from the loudspeakers.

by LEO SIMPSON

Many hifi fans do not realise that amplifiers with direct-coupled outlets to the loudspeakers can pose a real hazard—to the loudspeakers! By direct-coupling, we are referring to those amplifiers without output-coupling capacitors. Japanese manufacturers refer to them as OCL or "output capacitor-less".

There are several advantages in having an amplifier with direct-coupling to the loudspeakers. It results in better damping factor and improved power output at low frequencies. To the designer it enables elimination of at least one large electrolytic capacitor, with a consequent cost saving. And it also eliminates one possible cause of switch-on transients.

But all these advantages add up to zero if a failure occurs in the power amplifier and applies a large DC voltage across the loudspeaker(s). The most likely result of this is that the loudspeaker voice coils are burnt out before the owner realises that anything is amiss.

While the transistor or component that fails in the amplifier may be replaced at a cost of only a few dollars, repair or replacement of the loudspeakers can be very much more expensive. In the case of many imported loudspeaker systems, replacement of a single driver may easily set you back by more than one hundred or more dollars.

Another problem which is common to many solid-state amplifiers is that of switch-on transients. This is more likely to occur in amplifiers with output coupling capacitors—when the output capacitors charge up there can be a loud thump emitted from the loudspeakers. Usually the large DC charging pulse is not likely to damage the loudspeakers, but its audible effect can be annoying.

Both of these problems can be eliminated with the Loudspeaker Protector featured here. Indeed, similar circuits are now featured in many expensive high-power amplifiers.

Another problem common to many solid-state amplifiers is that they can cause the loudspeakers to thump a short time after being switched off. The Loudspeaker Protector will also eliminate most of this problem, particularly where the thump occurs several seconds after switch-off.

Some amplifiers also occasionally give a sharp "crack" from the loudspeakers at the instant of switch-off. However, that is a problem which cannot be cured by this simple circuit.

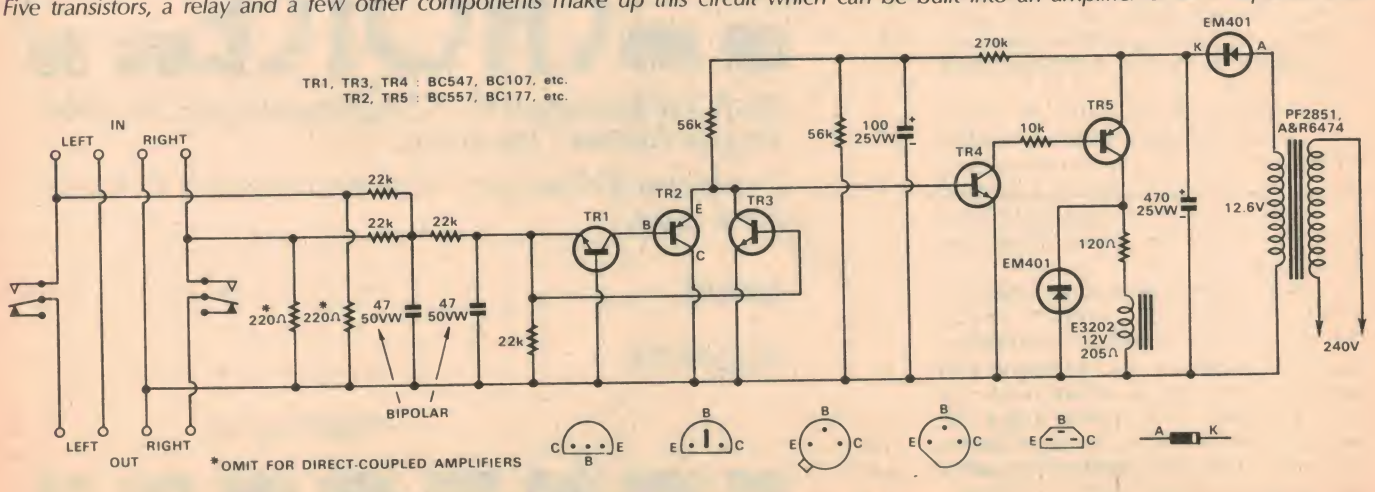
Refer now to the circuit. It is simpler than it appears at first sight. Basically it consists of a relay which normally connects the loudspeakers to the amplifier a few seconds after switch-on. If a DC voltage is subsequently applied across the loudspeakers, the relay disconnects them.

Five general purpose transistors are used in the circuit. Tr5 drives the relay direct. A diode in the collector circuit protects Tr5 against the inductive kick-back from the relay when it is de-energised. Tr4 controls Tr5 via the 10k resistor. When Tr4 conducts, so does Tr5.

Base bias for Tr4 is provided by a network consisting of two 56k resistors, one 270k resistor and the 100uF capacitor. At initial switch-on the 100uF capacitor has zero charge and so no forward bias is applied to Tr4 and the relay is off. After about two seconds, the capacitor is charged sufficiently to allow Tr4 and Tr5 to turn on and energise the relay which connects the loudspeakers to the amplifier.

Tr1, Tr2 and Tr3 form a rather

Five transistors, a relay and a few other components make up this circuit which can be built into an amplifier or as a separate unit.



EA LOUDSPEAKER PROTECTOR (WITH SWITCH-ON MUTE)

1/MS/13

incestuous triple which monitors the amplifier outputs for DC fault conditions. They function as follows:

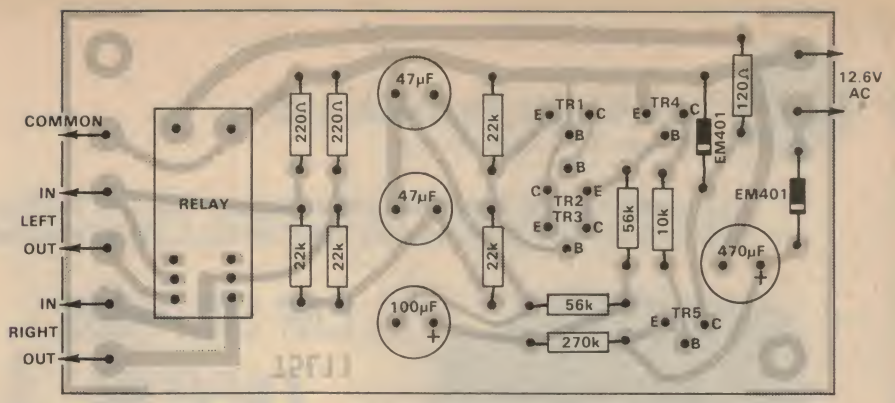
Both channels of the amplifier in question are monitored by Tr1, 2, 3 via a low-pass filter consisting of four 22k resistors and two 50uF capacitors. In a typical amplifier with direct-coupled output there is a normal "offset" DC voltage at the output which may be anywhere from about 20 millivolts to perhaps 200 to 300 millivolts. These normal offsets must not affect the monitoring network.

PARTS LIST

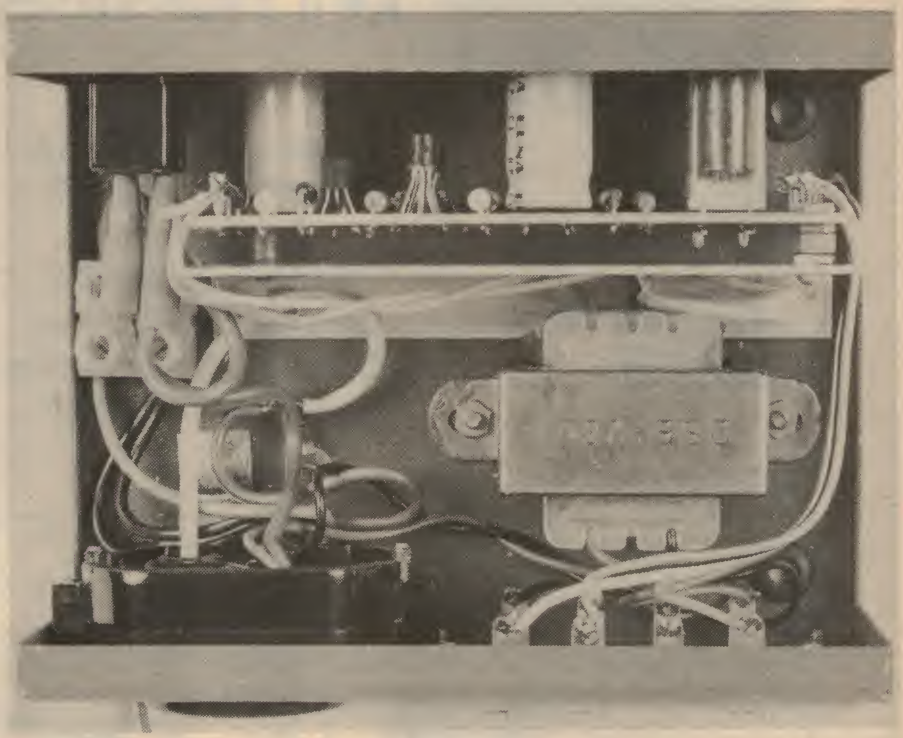
1 case and lid
1 PC board, 102 x 51 mm, code 75L11
1 PC board bracket (see text)
1 flush-mounting mains socket
1 three-pin mains plug
1 power transformer, 12.6V secondary
1SPST toggle switch
2 four-terminal connector strips
3 BC547 NPN silicon transistors
2 BC557 PNP silicon transistors
2 EM401 silicon power diodes
1 Varley E3202 relay, 12V double-changeover contacts
1 470uF/25VW PC electrolytic capacitor
1 100uF/25VW PC electrolytic capacitor
2 50uF/50VW PC non-polarised capacitors

RESISTORS
(¼ or ½W or 10% tolerance)
1 x 270k, 2 x 56k, 4 x 22k,
1 x 10k, 2 x 220 ohms, 1 x 120 ohms.
MISCELLANEOUS
7 PC stakes, length of three core flex, solder lug, grommet, rubber feet, screws, nuts, lockwashers, hook-up wire, solder.

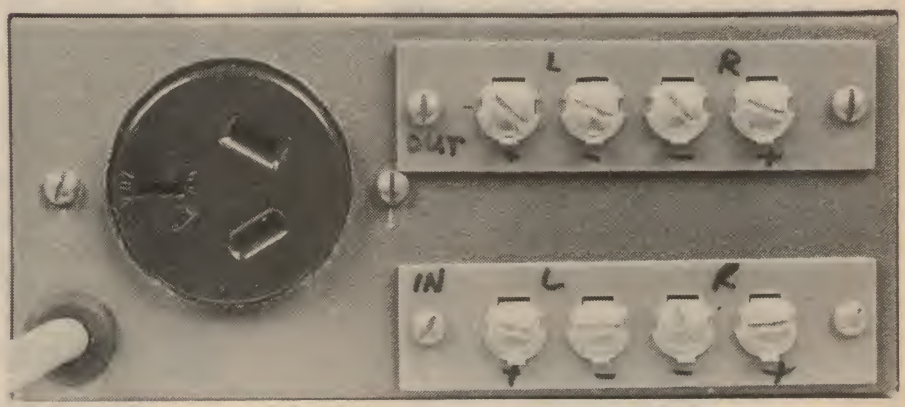
NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may be used provided they are physically compatible. Lower rated components may also be used in some cases provided their ratings are not exceeded. See notes on components in the text.



The PC board layout of the Protector. The 47uF capacitors are non-polarised.



The PC board was mounted vertically in the prototype. Below is the rear view.



If one of the amplifier outputs goes positive by more than two volts, Tr3 is forward biased and it conducts to remove the base bias from Tr4. Hence Tr4 and Tr5 turn off and the relay disconnects the loudspeakers. Similarly, if the amplifier output goes negative by more than two volts, the emitter of Tr1 is pulled negative with respect to its base. Tr1 then conducts as does Tr2, and so Tr4 and Tr5 are turned off as before.

So all the transistors function as simple switches which are only controlled by DC signals. AC signals have no effect due to the input filter.

The two 50uF capacitors in the input filter are non-polarised electrolytics. They have to be, since DC voltages of either polarity may be applied to them. The capacitors we used are made by Elna and are referred to by the manufacturer as being "bipolar"—a term normally applied to conventional transistors. We prefer the term "non-polarised".

The 220 ohm resistors on the circuit are marked with asterisks. These should be included where the Protector is used to eliminate switch-on thumps from amplifiers with output coupling capacitors. The resistors allow the output

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MODE	RANGE	ACCURACY (LM-4)	RESOLUTION (LM-4)	ACCURACY (LM-3)	RESOLUTION (LM-3)	INPUT RESISTANCE	TEST** CURRENT
VOLTS DC*	1 10 100 1000	±0.02% of Full Scale	100 μV 1 mV 10 mV 100 mV	±(0.1% F.S. + 1% Rdg.)	1 mV 10 mV 100 mV 1 V	10 MΩ	
VOLTS AC*	1 10 100 1000	±(0.1% F.S. + 0.2% Rdg.); 50-400 Hz (All ranges) ±(0.1% F.S. + 1% Rdg.); 400-50 KHz (1V range) ±(0.2% F.S. + 10% Rdg.); 400-5 KHz (10V & higher ranges)	100 μV 1 mV 10 mV 100 mV	±(0.3% F.S. + .8% Rdg.) 50/400 Hz ±(0.3% F.S. + 10% Rdg.) 400/5000 Hz	1 mV 10 mV 100 mV 1 V	10 MΩ, 20 pF	
KILOHMS	1 10 100 1000 10000	±0.1% of Full Scale	100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ	±(0.1% F.S. + 1% Rdg.)	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ		1 mA 100 μA 10 μA 1 μA 100 nA

* 1000 VDC or peak AC maximum any range.

**5 VDC maximum test voltage in K/MΩ mode.

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capacitors to charge in the delay period before the loudspeakers are connected. If the resistors were omitted there would be an awful bang from the loudspeakers when the relay is energised.

While the 220 ohm resistors are essential where the Protector is to be used with amplifiers having output capacitors, they should be omitted where used with amplifiers having direct-coupled outputs. If they are included there is a strong likelihood that they will be burnt out in the event of an amplifier fault.

As it stands, the Protector circuit can be built in a number of forms. First, it can be built into the amplifier it is to work with, and powered from it. The supply rail may be anywhere in the range from 12 to 45V DC. The only change necessary to adapt to differing supply rails is that the 120 ohm resistor should be varied so that no more than 12V is applied to the relay. Coil resistance of the relay specified is 205 ohms.

Current drain of the circuit with the relay energised is close to 60 milliamps. If it is run from the main positive DC rail in the amplifier the diode and 470uF filter capacitor may be omitted. Note that the zero volt rail (ie, earth) of the Protector should connect to the main earth point of the amplifier.

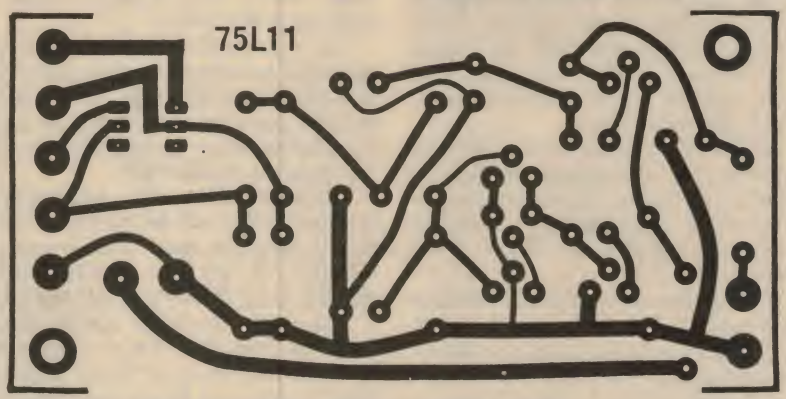
If it is inconvenient to power the Protector from the main positive DC rail of the amplifier it is possible to run it from an AC winding on the power transformer provided that one side of the winding is, or can be connected to the main earth of the amplifier. AC input voltage to the rectifier of the Protector may be in the range of 9 to 30VAC. If the resultant DC voltage is more than 25V, the voltage rating of the 470uF filter capacitor should be increased accordingly.

Where the constructor does not wish to incorporate the Protector into an existing amplifier it will be necessary to construct it as a separate unit with its own small transformer to provide the DC supply. Here again it can be built in one of two versions. Note that the Protector transformer must be energised at the same time as the amplifier.

Where the amplifier in question has switched 240VAC outlets the Protector can be plugged into the rear of the amplifier and controlled by the amplifier power switch. If the amplifier does not have a switched 240VAC outlet, the Protector will be required to have its own power switch and a 3-pin mains socket into which the amplifier can be plugged. The amplifier is then turned on and off with the Protector power switch. Our prototype is the latter version.

Our prototype was housed in a neat little case supplied by Bespoke Metalwork, 42c Sydenham Road, Brookvale, NSW. The case is denoted type MT1, comes in crackle enamel finish of blue, black or red and has a clear anodised aluminium lid. Dimensions are 136 x 60 x 104mm (W x H x D). Parts suppliers can order from Bespoke at the above address.

A flush mounting 3-pin outlet and two sets of four-way screw terminals are mounted on the rear of the case. The sets of terminals are for connection of output wires from the amplifier and wires to the loudspeakers. The front panel is bare except for the power switch.



Here is the full size copper pattern of the PC board.

A PC board coded 75L11 and measuring 102 x 51mm accommodates the circuitry. The relay is made by Varley, type E3202, and is soldered directly to the PC board. The non-polarised electrolytic capacitors can be soldered in either way round.

General-purpose small-signal silicon transistors can be used for this circuit. Tr1, 3 and 4 may be BC548, BC108 or any equivalent NPN type, but if the circuit is incorporated into an amplifier and has a DC rail of more than 30V then Tr4 should be BC547, 107 or equivalent. Similarly, Tr2 and Tr5 may be BC558, BC178 or equivalent PNP type, but if the supply rail is more than 30V, Tr5 should be BC557, 177 or equivalent.

Note that if the resistor in series with the relay is modified to cope with a higher voltage DC rail, its power rating should be adequate for the purpose. For a DC rail below 20V, a ½W resistor will suffice.

As it stands, the Protector is suitable for amplifiers with ratings up to about 100 watts RMS per channel. If it is to be used with higher rated amplifiers a relay with higher rated contacts will have to be used. The contacts in the relay specified have a rating of 5 amps.

Use PC stakes or pins to make connections to the PC board. These make it easy to make and break connections. The PC board was mounted on a vertical bracket slightly larger than the board and made of aluminium.

The power transformer is a miniature type with a 12.6V secondary. Ferguson PF 2851, A & R 6476 or DSE 2851 are suitable.

These transformers normally have a centre tap connection to the secondary. This should be coiled up and taped to prevent it shorting to the case.

The three-core mains cord should be passed through a grommeted hole in the rear of the case and anchored with a cord clamp. The earth conductor should be terminated to a solder lug on the chassis while the active and neutral wires are terminated to an insulated terminal block. Connections to the power switch, transformer and AC outlet are then made from the terminal block. On no account should any connection be made from the Protector chassis to the earth returns of the loudspeakers or amplifier

When assembly is complete, the Protector can be checked for correct operation without connecting it to an amplifier. Switch on and check that the relay closes after about two seconds. Drop out time for the relay after switch-off is about half a second. A shorter delay before the relay closes will occur if the Protector is switched on immediately after it is switched off.

Fault conditions at the input can be simulated with a nine-volt battery. Just connect across the inputs, either way, and the relay should open after a short delay of less than half a second. If you connect the battery to the output terminals of the Protector you can check that the relay is correctly breaking the circuit when a fault occurs. If it is, the relay will open and close repeatedly until the battery is removed.

When operation of the circuit has been checked, the unit can be connected to the amplifier and loudspeakers.

You can then sigh with relief, because your precious loudspeakers are now safe from damage if your amplifier pops an output transistor.

There is one other advantage of the Protector. It enables you to quickly kill the sound of an objectionable program, rather than letting it fade away after normal switch-off. For example, blah blah razzle dazzle and (click) . . .

Fluorescent Readout LSI Digital Alarm Clock

Here is yet another LSI digital clock. This versatile design provides for either 12 or 24 hour operation, has integral alarm and snooze facilities, and uses a bright 4-digit fluorescent readout display. If you want a digital clock with alarm facilities, this is the one to go for.

by GREG SWAIN

Digital clocks are certainly popular projects, judging by the success of the clock described in the April 1975 issue. Over 1500 were built in the space of 6 months, and the figure would certainly be much higher by now.

In view of this popularity, we decided to publish an alternative design of somewhat differing specifications. As with the clock described last April, the new unit is available from Dick Smith Electronics.

As can be seen from the accompanying photographs, most of the clock circuitry is accommodated on a small PC board measuring 104 x 60mm. The unit may be constructed for either 12 or 24 hour operation, and is housed in an attractive plastic case supplied as part of the kit. Overall dimensions of the completed unit are a compact 148 x 77 x 60mm (W x H x D).

The new clock differs from the one described in the April issue in a number of important ways. First, there is the advantage of the integral alarm facility which allows the alarm to be set up to 24 hours in advance. A snooze button permits an activated alarm to be turned off and reset for another 7 minutes. And by the addition of some simple circuitry, the new clock can be used as an accurate time switch. This feature is described later on in the article.

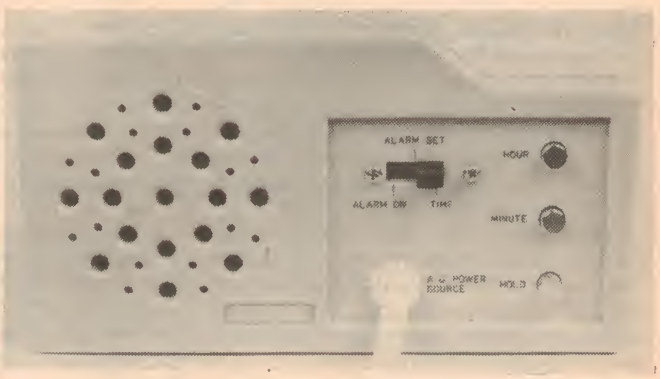
On the debit side, the new clock provides no seconds option, there being a 4-digit readout only as a result of display and chip limitations. In addition it is slightly more complicated to assemble than the April clock.

Ultimately then, the choice between the two clocks will be based on whether you want a four digit readout or six, and whether or not you require the alarm facility. Cost differences are marginal.

The clock described here is designed around a single Texas Instruments TMS3834 digital clock chip. Contained on the LSI chip is all the electronics circuitry necessary to convert the 50Hz pulse input at pin 28 into a multiplex readout for 4 digits, together with alarm setting and alarm output facilities.

Basic clock operation is as follows. First, half rectified 50Hz is applied to pin 28 of the clock chip. An internal signal shaping network squares the signal up in a signal shaping circuit, and then divides it down to 1 pulse per second (1pps). The 1pps signal is fed to a counter which cycles in BCD from 00:00 to 23:59 in the 24 hour mode, or from 01:00 to 12:59 in the 12 hour mode.

BCD output from the clock counter is decoded and multiplexed to drive the display.



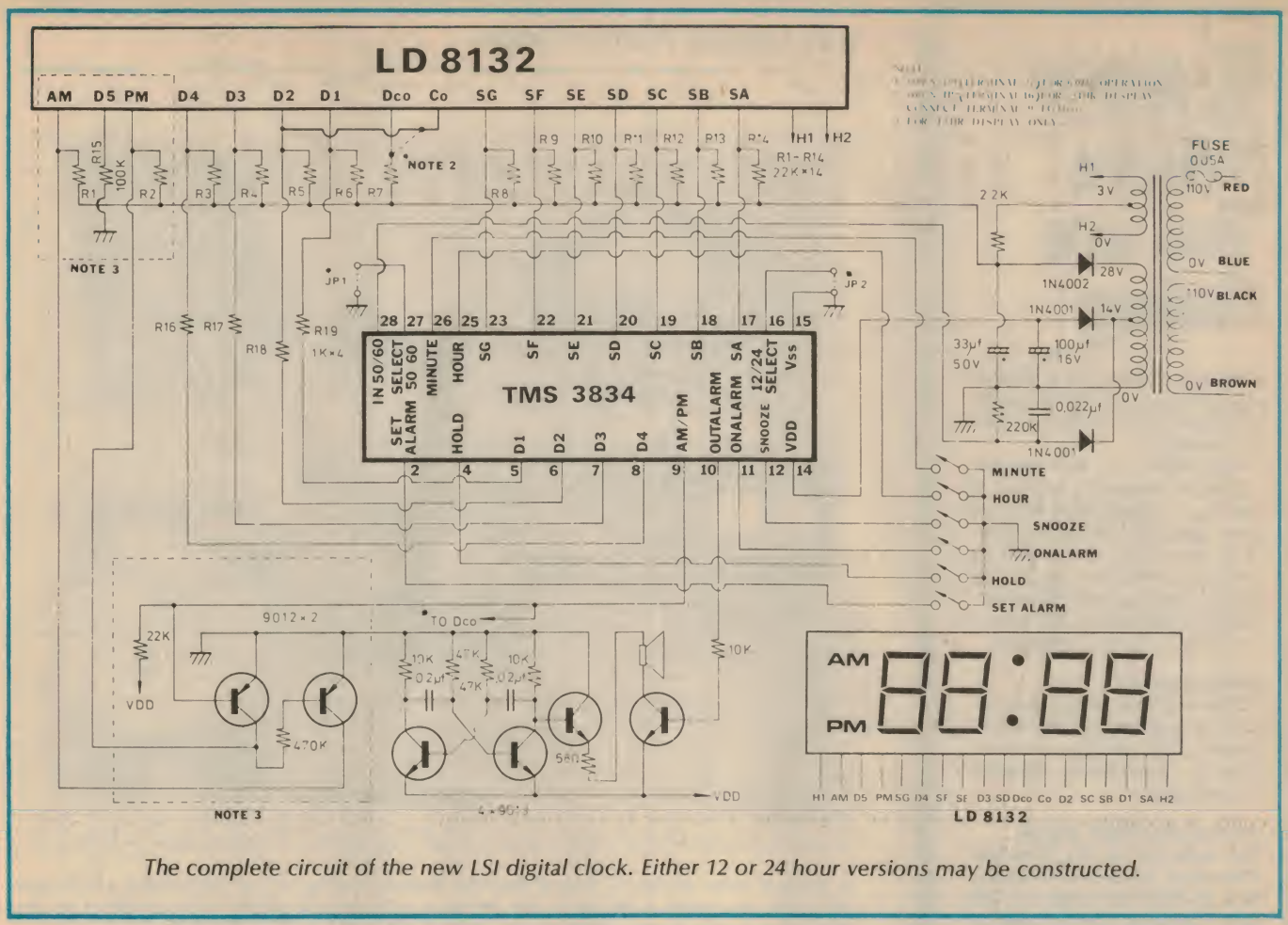
Rear view of the completed unit showing the time setting and alarm setting facilities.

The clock in finished form, housed in the plastic case supplied with the kit.

In simple terms, multiplexing involves the simultaneous transmission of more than one piece of information via the same path. The path can be thought of as being time shared, if you like. In this case, we need to display up to four numbers simultaneously. Each number has up to seven segments each requiring an item of information.

In fact, when all is taken into consideration each seven segment display requires eight separate lines. Multiply this by four for a 4-digit display and we would need 32 lines. However, in the case of a clock, the most significant digit can never exceed 2 when operated in the 24 hour mode, or 1 when operated in the 12 hour mode. This reduces the number of lines required to 31 and 27 respectively.

If the clock chip were to use a conventional seven segment decoding,



The complete circuit of the new LSI digital clock. Either 12 or 24 hour versions may be constructed.

therefore, it would require 31 output connections to the display, plus all the input, supply and control connections. Although not impossible, it would tend to make the package somewhat unwieldy.

Multiplex operation gets around the problem by not attempting to show all the digits continuously. Instead the digits are flashed sequentially, usually at a rate of about 1kHz. At this rapid rate, they all appear to be on continuously.

As with the previous clock, a bright fluorescent readout display is employed. However, whereas the previous clock used separate readout "bottles" for each digit, the digits here are encapsulated in a common "flat" glass envelope. Actual height of the readout numerals is 12.5mm.

Basically, the fluorescent readout display consists of a directly heated cathode, a control grid per digit, and a number of anodes—one for each segment of each digit of the display. In addition, anode segments and control grids are provided for the colon and for the AM and PM indication.

Two very fine wires running horizontally across the face of the display provide the common cathode for all digits. One side of the cathode is tied to the negative supply rail via a 2.2k resistor, and it is fed from a 3V winding on the transformer.

A fine mesh immediately in front of the anodes for each digit acts as the control grid. In this case the anodes are tied to the negative supply rail via 22k isolating resistors, and are normally held off. When driven by the segment driver output of the clock chip, the appropriate segments are brought to ground potential and are therefore positive with respect to the cathode. The display can then be made to light up by making the grid positive with respect to the cathode.

All equivalent anode segments of the various digits are bussed to seven common lines, each driven by a segment driver output of the clock chip (pins 17 to 23). The various control grids are driven by the clock chip via 1k pull-up resistors (pins 5 to 8). Thus for a 4-digit display, there are only 11 separate connections from the clock chip.

To display the various digits correctly, control signals are applied sequentially to each of the digit grids in turn. At the same time, the corresponding common segment lines for each digit are brought to ground by the segment driver output of the clock chip. The signals change appropriately as grid voltage is applied to each digit.

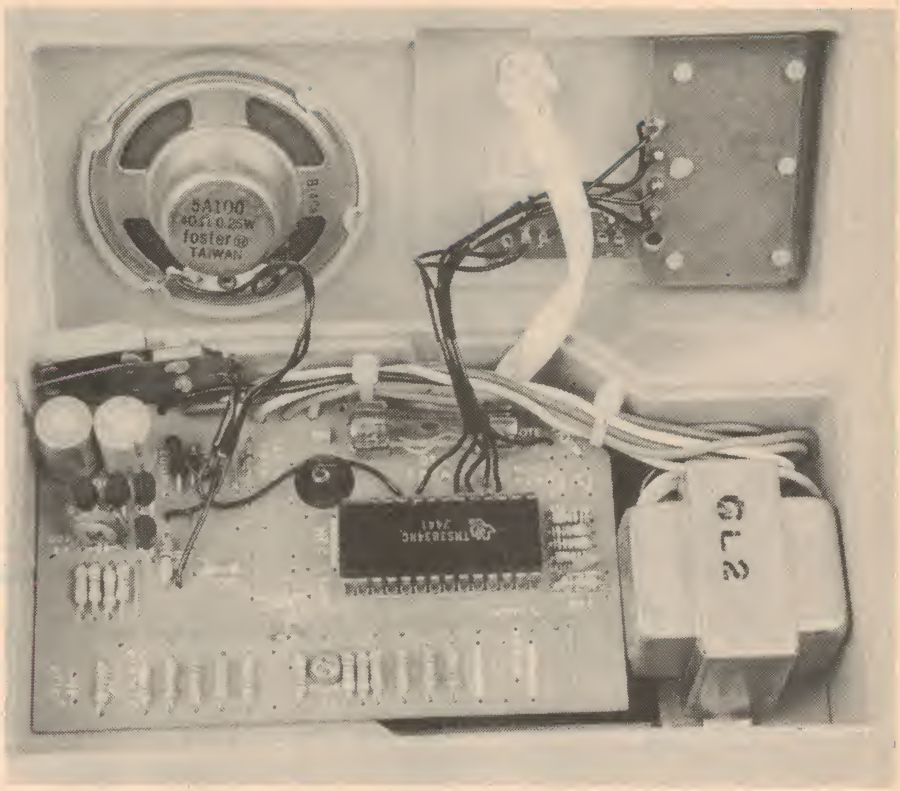
The alarm circuitry consists of a free running or astable multivibrator which generates an audio tone. This is coupled to a small loudspeaker via an NPN driver transistor. A fourth transistor, also in series with the loudspeaker, acts as a switch. When the time counter within the clock chip reaches the same count as the alarm counter, the alarm output (pin 10) delivers a series of 1 second pulses to the base of this transistor, turning it on and off. The loudspeaker thus delivers a pulsed tone.

Three push-buttons are provided for time setting: Hold, Hour Advance, and Minute Advance. The latter two buttons rapidly cycle the time forward. Then, by using the Hold button, you can hold the time static until the precise time required is reached. Note that when the Hold button is released, the clock will begin counting from zero seconds.

Note also that this clock eliminates illegal time displays at switch-on. When power is first applied, 0:00 is displayed. The correct time is then set using the time-setting push-buttons as outlined above.

The clock is, however, tolerant of power failures of up to five seconds (although it will discontinue counting during such interruptions). In practice, this means that the clock will continue to operate despite momentary power failures, as in the case of severe electrical storms. This is obviously a desirable feature where reliance has been placed on the alarm facility.

The kit from Dick Smith Electronics is



A general view of the PC board and the internal wiring of the completed prototype. This unit has been built up in the 24 hour operational mode and modified so that the colon is displayed continuously. Full details are given in the text.

available in two versions. The first and the one most likely to be of interest to EA readers, is the kit version for $34.95. For the less confident, a fully built and tested version is available for $37.50. Postage and packing is an extra $1.00 in both cases. At these prices, we judge both alternatives to be good value for the money.

The kit itself is a cinch to put together (once you have decided on whether you want a 12 hour display with AM and PM indication, or a 24 hour display with or without flashing colon). Perhaps the most complicated aspect of assembly is the mechanical construction, particularly the self assembly push-button switches. However, the mechanical layout is clearly explained by means of detailed diagrams supplied with the kit, and there should be no problems here.

Normal good soldering practice should be followed when wiring up the small PC board, which is coded and pretinned for easy assembly. Begin by soldering resistors and capacitors into position, not forgetting the number of wire links that must be added, according to your choice of options. Take particular care when soldering polarised components into position, i.e., transistors and electrolytic capacitors.

Two integrated circuit connector strips (as made by Utilux and other companies) are supplied as the IC socket. The terminals should be inserted and soldered with the leader strip intact. The leader strip should then be snapped off so that each pin connector is separated from its neighbour.

Before mounting the display, it will be necessary to complete the external wiring to the function switch, the time setting switches, and the speaker. This is because the display obstructs the foil side of the board when mounted in position.

The display tube is mounted on the copper side of the PCB. Push the pins all the way in to the step and solder. The tube is then bent through ninety degrees so that it is parallel to the board. A plastic "locator mount" is fitted between the top edge of the display and the board.

Due care should be exercised when handling the TMS3834 clock chip. This is a MOS device and, as such, is susceptible to damage by static charges. Do not touch the pins of the device. Instead, hold the two ends of the device between your fingers, and push it firmly and evenly into the IC connector pins.

Be sure to orient the IC so that the notched end is as indicated on the circuit board. Because the IC can be so easily damaged, we recommend that it be left

in its protective foam package until required. It should be installed in the circuit as the final job of assembly.

As originally supplied the clock is intended to be built either in the 12 hour mode with continuous colon and AM and PM indication, or in the 24 hour mode with flashing colon. As a matter of personal preference, the author initially constructed the clock in the latter mode.

However, the flashing colon was subsequently found somewhat irritating. Worse still, the brightness of the display varied in sympathy with the flashing colon, this effect being slight but noticeable.

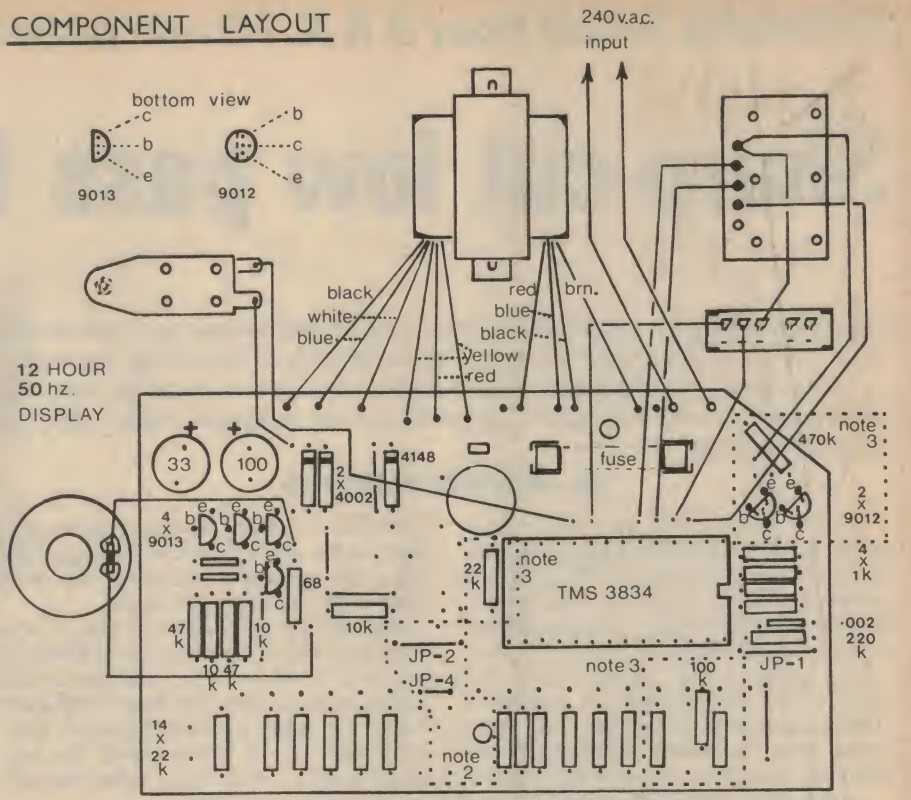
The solution to this problem is fortunately quite simple, and involves modifying the clock slightly so that the colon is displayed continuously. All you have to do is omit the JP-3 wire link, and insert the JP-4 link. Note that the JP-4 link simply involves tying the appropriate two pins of the display (Dco and Co) together after the display has been inserted and soldered into position.

A word of warning for those who construct the clock in the 12 hour mode. As originally conceived by the manufacturer, the TMS3834 IC clock chip was intended for 24 hour operation only. Advice to hand indicates that the 12 hour mode was added to the chip almost as an afterthought, as was the AM and PM indication.

The result of all this is that the chip has an inherent design limitation when operating in the 12 hour mode. This limitation affects the AM and PM indication signs, such that these are always an hour late in changing. In other words, instead of changing at 12 noon and 12 midnight, the AM and PM signs change at 1 o'clock in the afternoon and 1 o'clock in the morning. This means that between the hours of 12 and 1, the sign shown will always be the wrong one!

What can be done about it? Absolutely nothing. Those who build the clock in the 12 hour mode will just have to be content with this feature which, at worst, can only be considered a minor annoyance. Of course if you build the clock in the 24 hour mode, the problem becomes irrelevant anyway.

COMPONENT LAYOUT

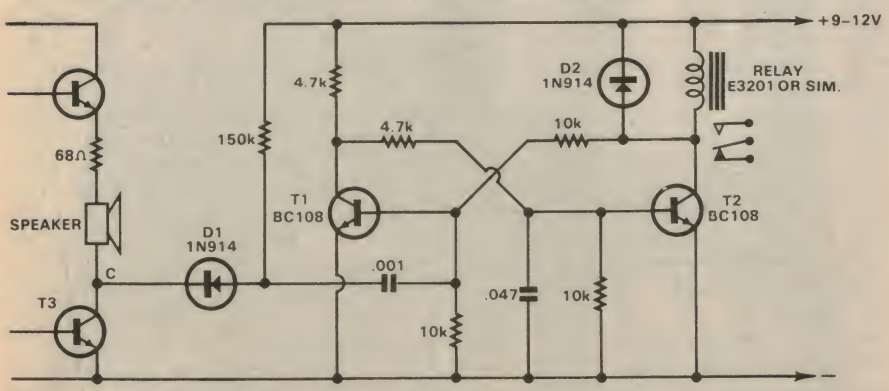


Component layout and wiring diagram of the 12 hour version of the clock. For the 24 hour version with continuous colon omit JP-2 and all "note 3" components, and insert a 22k resistor in "note 2" (insert JP-3, omit JP-4 for flashing colon).

As mentioned earlier, the alarm output of the clock chip can be used to turn another appliance on or off at a predetermined time. As accurate time switch is a very useful device, and can be used to control all manner of equipment eg, radios TVs, lights, garden watering equipment, tape recorders etc. The extra circuitry involved is straightforward, and is reproduced here for the benefit of interested constructors.

The circuit is one recommended by Dick Smith Electronics. It has not been built and tested in our lab.

Actually the circuit is a bistable flip-flop. At initial switch-on transistor T2 is prevented from conducting by the .047uF capacitor in its base circuit so that T1 turns on. This means that the relay is normally unenergised.



This simple circuit will allow you to adapt your clock for use as an accurate time switch. Use it to automatically turn on lights, TVs, tape recorders etc.

When the alarm circuit is activated, T3 is turned on, forward biasing diode D1 which delivers a turn-off pulse to the base of T1 via the .001uF capacitor. This turns T1 off and T2 on, energising the relay. The relay remains energised until power is removed from the bistable circuit.

The E3201 relay specified in the circuit is only a small type, intended for low power applications (5A at 30VDC or 240VAC). Relays of similar specifications may be substituted, and these should have an operating voltage of 12V and a coil resistance of approximately 200 ohms. Whichever relay you use, make sure that its ratings are adequate for the job.

Note that for the circuit shown, the usual alarm sound will occur when the alarm is activated. If this condition is not required, simply disconnect the lead between the speaker and the collector of T3. In fact, we suggest that the appropriate leads be terminated at a small switch so that either the alarm facility or the bistable switch may be selected at will, or both together if required.

Note also that some kind of switching arrangement will be necessary to enable the bistable switch to be reset. This simply involves interrupting the positive supply rail to the bistable circuit. We leave the details to individual constructors.

And there you have it—a further LSI digital clock project, with its own unique features. The choice is yours.

Improving sound from 9.5 & 16 mm projectors—2

Sharp-cut low pass filter

Offering very sharp roll-off at any desired turnover frequency, the simple low-pass filter described here is very suitable for improving the signal to noise ratio from old movie sound tracks. It is also suitable for tailoring bandwidth in amateur radio transmitters—for example, after clipping or peak limiting.

by JAMIESON ROWE

If you fit your projector with a silicon photodiode, provide it with the optimum load resistance and feed it through the updated preamp circuit as described in the first of these articles, you should find that the reproduction from most normal sound tracks is very good indeed. But there is still the problem of very poor sound tracks, some of which need much more than "normal" treatment if the reproduction is to be made acceptable.

I soon discovered this myself when testing the updated preamp. Reproduction from most films seemed much improved, and quite impressive. But that from the very poor contrast print which had actually spurred me into rebuilding the unit was still very noisy, and left a lot to be desired. It was as if the complete sound track was accompanied by a continuous and torrential rainstorm!

My first thought was to try coloured filters in the sound scanning light path, in an effort to improve the effective contrast of the track. However, although I tried a variety of different coloured filters, the results were inconclusive.

At this stage I thought the best idea was to talk to someone who had more experience with the problem. So I contacted Mr Murray Stevenson, who was Chief Engineer of TV station ATN-7 in Sydney at its inception and for many years. If anyone would have experience with coaxing sound from poor sound tracks, I reasoned, he should!

This certainly turned out to be the case, and Murray very kindly gave me the benefit of his experience. Unfortunately there isn't room here to pass on all of the useful information he was able to give me, but the upshot was that he suggested I try an adjustable turnover low-pass filter with a sharp cutoff slope.

Apparently experience in the TV stations has shown that this type of filter can be very useful with problem sound tracks. It allows the total bandwidth (and hence the noise bandwidth) to be trimmed back, to the point where the best compromise is reached in terms of effective signal-to-noise ratio.

At times, I gather, it can prove necessary to chop back the bandwidth to as low as 2.5kHz to obtain acceptable reproduction, although this rather drastic degree of filtering is not often needed. Despite the low bandwidth, such films can still sound acceptable, particularly if the bass response is reduced a little as well. And the clarity of speech can actually be improved by having a small peak in the response of the main low-pass filter, just before its steep cutoff.

Armed with this information, I decided to build up an adjustable filter of the type required. My first approach was to use a couple of modern op-amps, in an active filter configuration. However while these worked, they had to be very critically adjusted in order to achieve a suitably sharp cutoff slope. And it became apparent that this type of filter is not really suitable where the turnover frequency must be switched over a significant range.

When I mentioned this result to Neville Williams, he suggested that it might be worthwhile looking at a simple L-C filter design he had used many years ago in a scratch and heterodyne filter project. We looked up the project concerned, which turned out to be in the December 1949 issue of "Radio and Hobbies". And sure enough, the basic filter configuration did look as if it would be suitable for the present purpose.

The basic filter is shown in Fig. 1. It uses three inductors and two capacitors, with the two series inductors mutually coupled. Although its detailed operation might be rather complex to analyse, broadly speaking it seems to combine the characteristics of "T" and "pi" section filters. With suitable scaling of component values, it can give a passband flat-

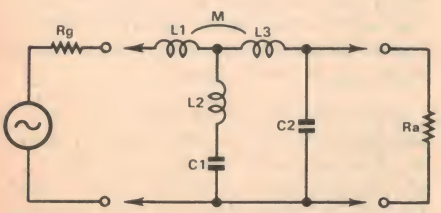
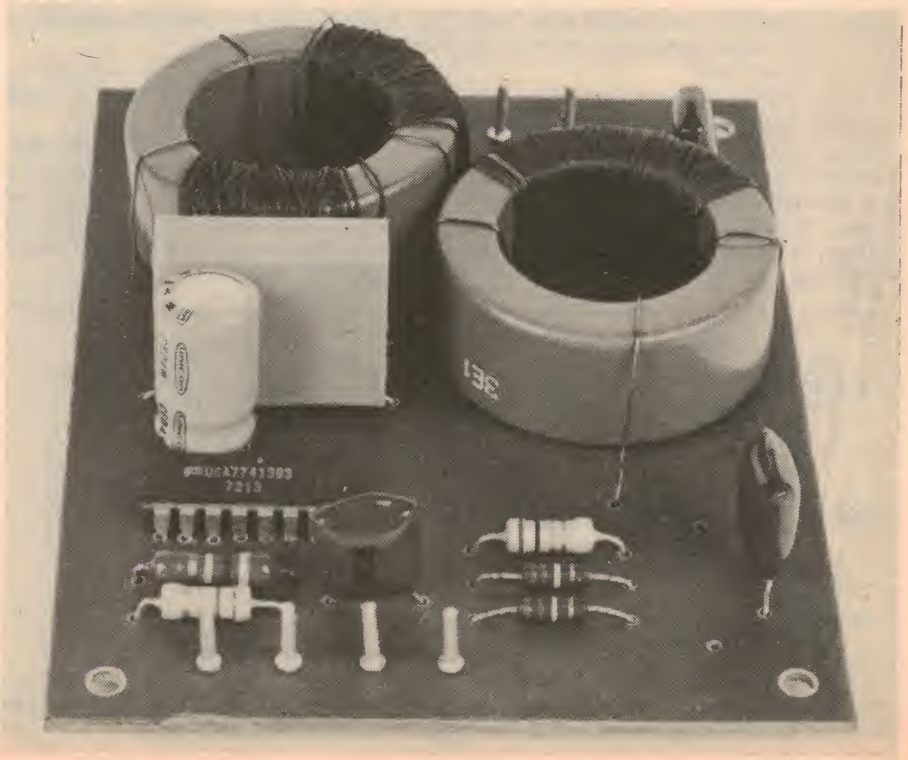


FIG. 1: BASIC FILTER CONFIGURATION



At right is the filter board as wired for fixed-cutoff operation. The basic filter configuration is shown above.

ness of better than 1dB, with a cutoff slope of around 22dB per octave.

As originally described, the filter was designed to work at an impedance level of 2k, driven by a triode-connected 6SJ7 valve. The inductors were air-cored types, wound on home-made wooden bobbins. I decided to aim for a lower impedance level—say 1k, with the idea of reducing the required inductance values, and hopefully making them easier to wind. I also decided to try winding them on ferrite toroids, as this would not only reduce the number of turns needed, but also obviate possible hum pickup.

To cut the story short, this approach has turned out to be quite successful. As you can see from the circuit of Fig. 2 and the photograph, I have been able to come up with a simple filter unit of updated design, which seems to do the job very well. The complete circuit mounts on a small PC board, runs from 18V DC, and has unity gain.

You can either build it up with fixed capacitors on the PC board, giving a fixed turnover frequency, or use a two-pole switch as shown to give a selection of turnover frequencies. The switch can also be used to give straight-through or "flat" operation, where filtering is not needed.

For film work, the filter unit is intended to be connected between the preamp described last month and the main amplifier. It will handle the output level produced by the preamp without significant distortion, and with negligible effect on the system signal to noise ratio. Its own output impedance is around 5k, which should be suitable for feeding into most solid state or valve amplifier systems.

Of course there is no reason why you can't use the filter for other applications. It would be quite suitable for use in a modulator for amateur radio work, either for simple bandwidth restriction or for cleaning up the output from a speech clipper. It would also be suitable for audio filtering in direct conversion receivers.

Getting back to the circuit in Fig. 2, you can see that it is basically the filter of Fig. 1 provided with switching for the two capacitors. A buffer amplifier using a uA741 or TBA221 op amp is used to drive the filter from a stable source, and also provides a gain of 2 to make up for the filter losses.

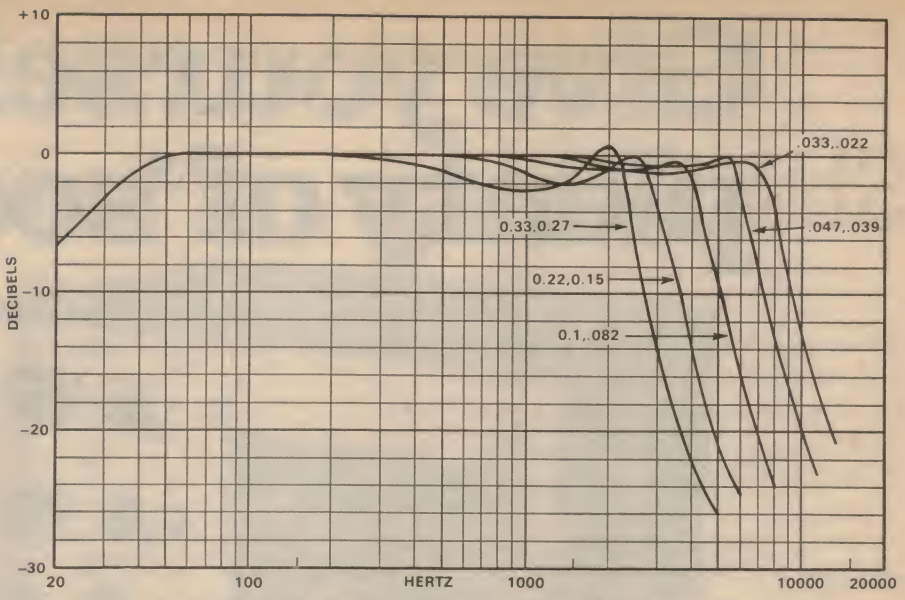


FIG. 3: RESPONSE OF SHARP CUTOFF LOW-PASS FILTER WITH 1k SOURCE, LOAD

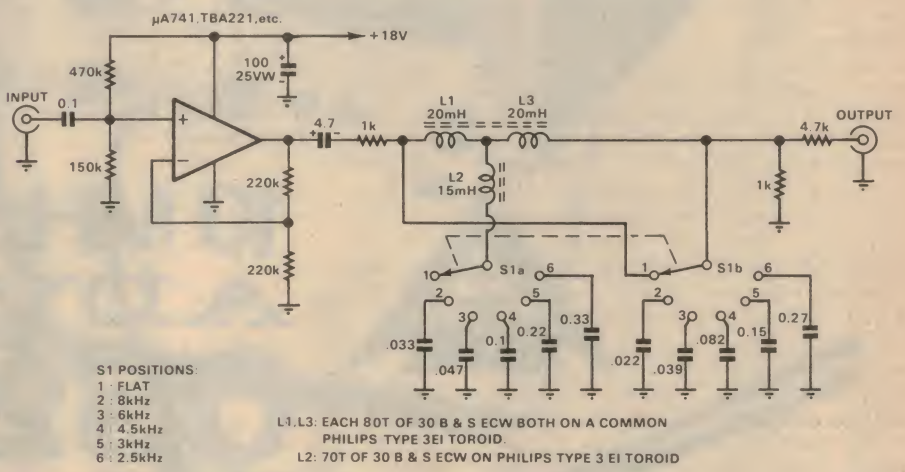


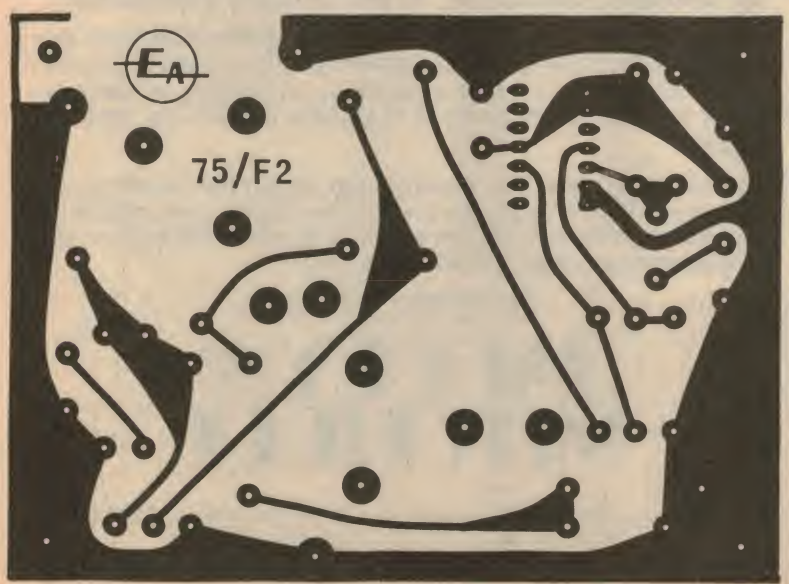
FIG. 2: SHARP CUTOFF LOW-PASS FILTER

1/F/8

Low frequency response of the complete filter unit is 3dB down at around 30Hz, which is more than adequate for film work. It could be tailored if desired by reducing the values of the buffer input and output coupling capacitors, from their current values of 0.1uF and 4.7uF.

Inductors L1 and L3 are mutually coupled by winding them on a single ferrite toroid, while L2 is wound on a second toroid. Both toroids are the Philips type 3EI (catalog number 4322-020-36571), which has a plastic coating to permit the wire to be wound on directly. At the time of writing this toroid is in good supply, and should be obtainable from your usual supplier.

L1 and L3 are each 80 turns of 30 B&S enamelled copper wire, giving about 20mH each with unity coupling. L2 is 70T of the same wire, giving about 15mH.



The PC board pattern for the filter, reproduced actual size to allow tracing if desired. The isolated pads are for toroid anchoring.

Give yourself plenty of 'scope.

10 MHz ADVANCE OS250 Dual Trace Oscilloscope

BRIEF SPECIFICATIONS

Display: 5 in flat faced CRT giving 10cm x 8cm display EHT — 3.6 kV overall.

Vertical Deflection: Two identical input channels. Y1 and Y2. **Bandwidth** (—3dB) DC—10MHz. **Sensitivity** 5mV/cm to 20V/cm in 1-2-5 sequence. **Input Impedance** 1M Ω/approx. 28pF. **Input Coupling** DC-GND-AC.

Display Modes: **Single Trace** Y1 and Y2. **Dual Trace** chopped or alternate modes, automatically selected on timebase switch. Chop rate approx. 250kHz. **X-Y mode** with Y1 input giving X deflection and Y2 input giving Y deflection. Bandwidth DC to 500 kHz $<$ 3° phase shift at 200 kHz.

Horizontal Deflection. **Timebase**—1 μs/cm to 0.5 s/cm in 18 ranges (1-2-5) sequences. **X Expansion** —X10 pull switch gives fastest speed of 100 ns/cm. Variable control gives $>$ 2.5:1 reduction in sweep speed.

Trigger: Variable level control with option of bright line in absence of signal. **Source** Internal Y1 + or —
Y2 + or —
External + or —
Coupling AC, AC fast TV Frame. **Sensitivity** Internal 2mm approx. 40Hz-2MHz. External 1V approx. 40Hz-2MHz. Internal 1cm approx. 8Hz-10MHz. External 5V approx. 8Hz-10MHz.

Additional Facilities: Calibrator 1V ± 2% square wave at supply frequency. Dimensions .18cm(7″) x 29cm(11½″) x 42cm(16½″). Approx. 7 kg.(15 lb).

Specifications quoted are for general guidance only, are subject to verification and change without notice.

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SHARP-CUT FILTER

Because of the closed magnetic circuit of the toroids, the windings are not critical in terms of shape, nor is it necessary to have L1 and L3 overwound or butting.

Winding toroids is not much fun, of course, but in this case there are only a few turns. You'll need about 3 metres of wire for the two larger windings, and 2½ metres for the smaller. All three can be wound quite easily in about 30 minutes.

As you can see, I have produced a small PC board to make the filter unit easy to assemble. Coded 75/f2, it measures 100 x 75mm. Space is provided for mounting the two toroids on the board, held in place by three short lengths of wire—soldered to isolated copper pads so that they don't form "shorted turns".

The wiring of the PC board is quite straightforward, and should be evident from the small diagram. Note that the pattern has been arranged so that you can drop in an op amp in either the 14-pin DIL, or the 8-pin "mini-DIL" packages. You could also use one in a round can, by bending its leads to suit.

Note also that if you want the filter to have only a single fixed turnover frequency, the capacitors can be mounted directly on the board.

The curves of Fig. 3 show the filter characteristics obtained with the five capacitor combinations shown in the circuit. Note that the combinations giving the two lowest turnover frequencies produce peaks of between 2 and 3dB just before roll-off. This gives a small amount of ringing, which appears to improve intelligibility.

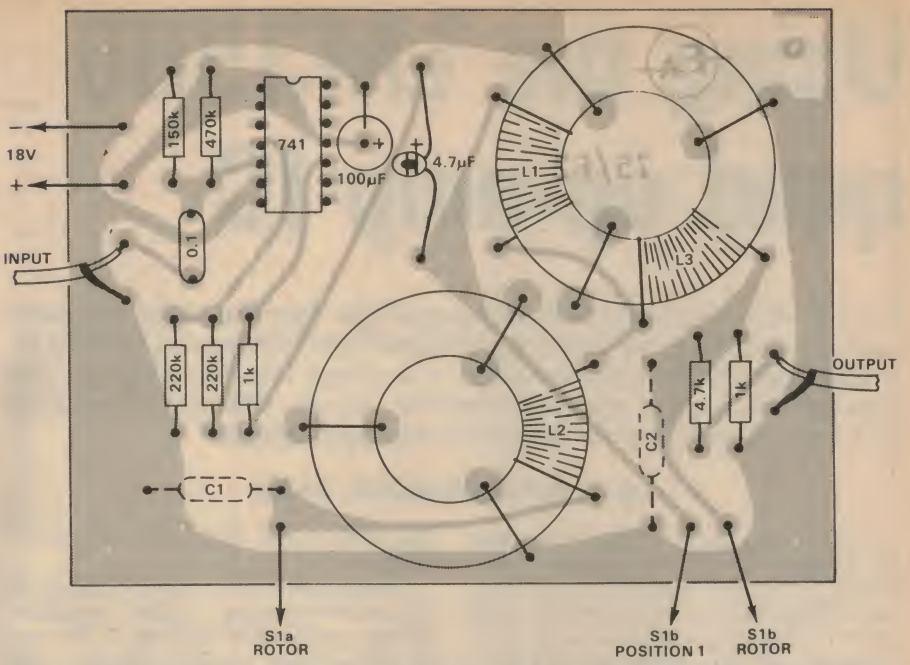
The capacitor combinations shown give approximate turnover frequencies of 8, 6, 4.5, 3 and 2.5kHz respectively, together with the "flat" characteristic. These provide quite a lot of flexibility, and should cope with most requirements. However if you want a turnover frequency between any of these figures, or above 8kHz, this can be achieved simply by a suitable choice of capacitor values. Note that the value of C1 (in series with L2) is roughly 50% higher than that of C2.

Having used this filter for a while now, I am able to verify that the sort of characteristic it provides can be very worthwhile in improving the reproduction from poor sound tracks. Providing the film is not too atrocious, the filter allows quite a good compromise to be reached between noise and bandwidth.

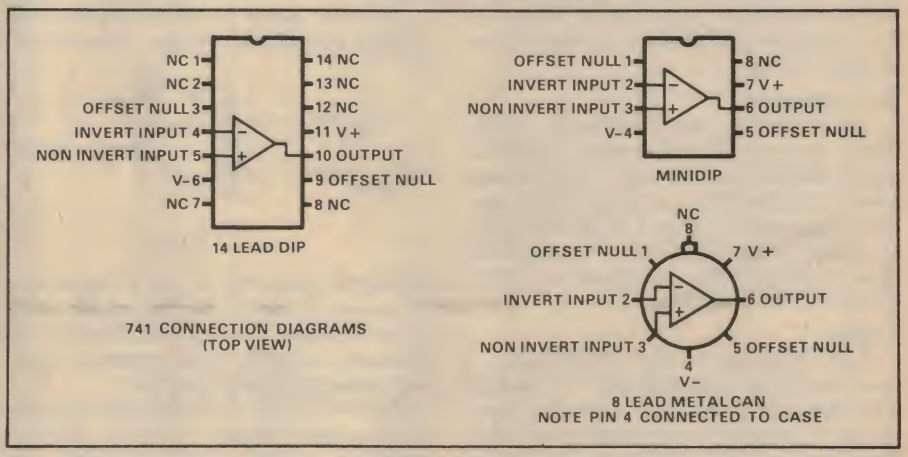
I must admit, though, that there still tends to be a problem with the very worst tracks—like that which started me off on this present foray. This is because with such films there is a basic conflict: the filtering which would be necessary to reduce noise to an acceptable level would also render the signal unintelligible!

Fairly obviously, no "static" filter of the type just described could cope with this sort of situation. If there is any possible solution to the problem, it lies in dynamic filtering: the use of a filter which changes its characteristics depending upon the presence or absence of signal.

I have been experimenting with a filter of this type, used in conjunction with the static filter just described, and the results seem promising. Details will be given in the third and final article in this series.



Above is the board wiring diagram for the filter, with the fixed filter capacitor positions shown dashed. If op amp packages other than the 14-pin DIL are used, connect using the guide diagrams below.



LIST OF PARTS

1 PC board, code 75/f2 (75 x 102mm)
1 uA741, TBA221 or similar op amp IC
2 Philips 3E1 toroids (catalog number 4322-020-36571)
1 2 section 1-pole 6-position rotary switch
RESISTORS (5% ¼-watt)
2 x 1k, 1 x 4.7k, 1 x 150k, 2 x 220k, 1 x 470k
CAPACITORS
1 0.1uF LV polycarbonate
1 4.7uF 6VW tantalum electrolytic or LV polycarbonate
1 100uF 25VW single ended PC type electro
Filter capacitors, LV polycarbonate: 1 x .022, 1 x .033, 1 x .039, 1 x .047, 1 x .082, 1 x 0.1, 1 x 0.15, 1 x 0.22, 1 x 0.27, 1 x 0.33
MISCELLANEOUS
PC connection stakes, approx. 8½ metres of 30 B&S enamelled copper wire for winding coils on toroids, connecting wire, solder, metal case if required, suitable 18V DC power supply, two audio connectors as desired.
NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used, providing they are physically compatible. Components with lower ratings may also be used in some cases, providing ratings are not exceeded.

Using the LM3900 quad op-amp IC

If you're working with circuits using op-amps, then you're at a disadvantage if you don't know about the National Semiconductor LM3900 IC. It offers no less that four op-amps in a single low-cost package, and although these use a slightly unfamiliar "current difference" input circuit, they can be used for many common applications.

by J. BRIAN DANCE, M.Sc

One of the most economical linear integrated circuits available at the present time is the National Semiconductor LM3900 device. Although the retail price of this IC is only around $1.75, it incorporates four separate amplifiers which are designed to operate from a single power supply line. They can be used in a wide variety of applications, from waveform generators to phase-locked loops, and produce a large output voltage swing.

Encapsulation

The LM3900 is encapsulated in a standard 14 pin dual-in-line case with the connections shown in Fig. 1. The characteristics of the device are specified over the temperature range 0°C to 70°C, but a similar (marginally more expensive) device, the LM2900, can operate over the range -40°C to +85°C.

Inputs

Each amplifier of the LM3900 has a non-inverting input (marked +) and an inverting input (marked -), but the input circuit is different from that of conventional operational amplifiers. The output voltage depends on the difference between the two input currents rather than the difference between two input voltages.

The special symbol recommended for current differencing 'Norton' amplifiers of this type is shown in Fig. 2. The use of this symbol avoids confusion with other types. The arrow on the non-inverting input shows this is a current input.

The two inputs of each amplifier are kept at one diode voltage (about 0.5V)

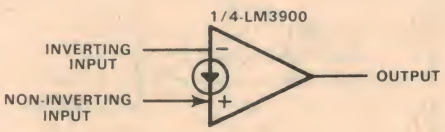


FIG. 2

above the potential of pin 7. Input voltages must be converted into currents by series resistors in the input circuit; for optimum stability, metal oxide or metal film resistors should be used.

The LM3900 can be used over the wide power supply range of 4V to 36V; its amplifiers provide outputs which can vary between 1V less than that of the positive line and a fraction of a volt above

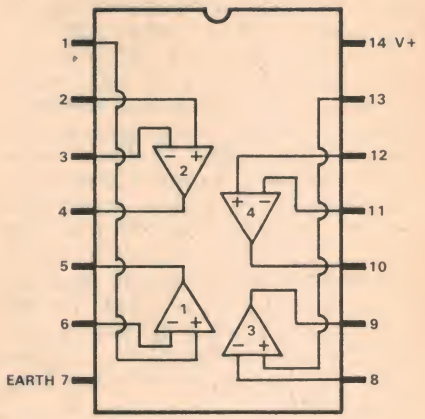


FIG. 1

ground potential. Alternatively, one can feed the device from balanced supplies of between ±2V and ±18V. The supply current is typically 6.2mA (max. 10mA) when the output current from each of the four amplifiers is zero; this supply current shows little variation with the supply voltage or with temperature.

The LM3900 may be damaged if the power supply is connected with the wrong polarity. The shorting of one of the outputs to ground or to the positive supply will not cause immediate damage, but may result in excessive heat dissipation and damage within a short time.

For simplicity, the power supply connections to pins 7 and 14 of the LM3900 will not be shown in the following circuit examples.

Simple Amplifiers

The simple inverting amplifier shown in Fig. 3 can be used at audio or higher frequency and provides a gain of R2/R1 (=20 with the values shown). If one wishes the quiescent output voltage to

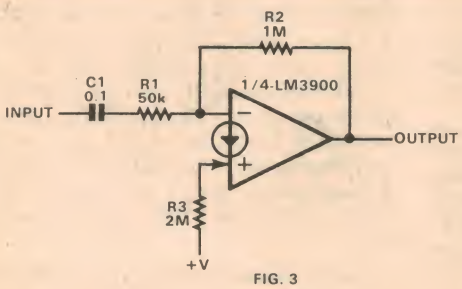


FIG. 3

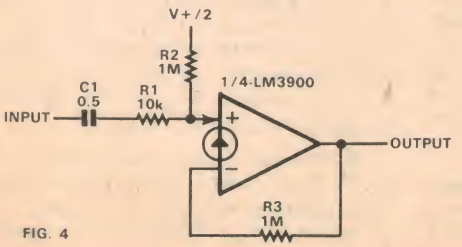


FIG. 4

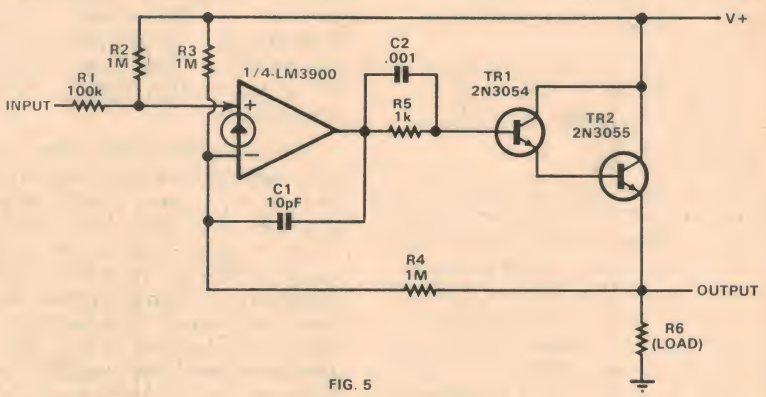
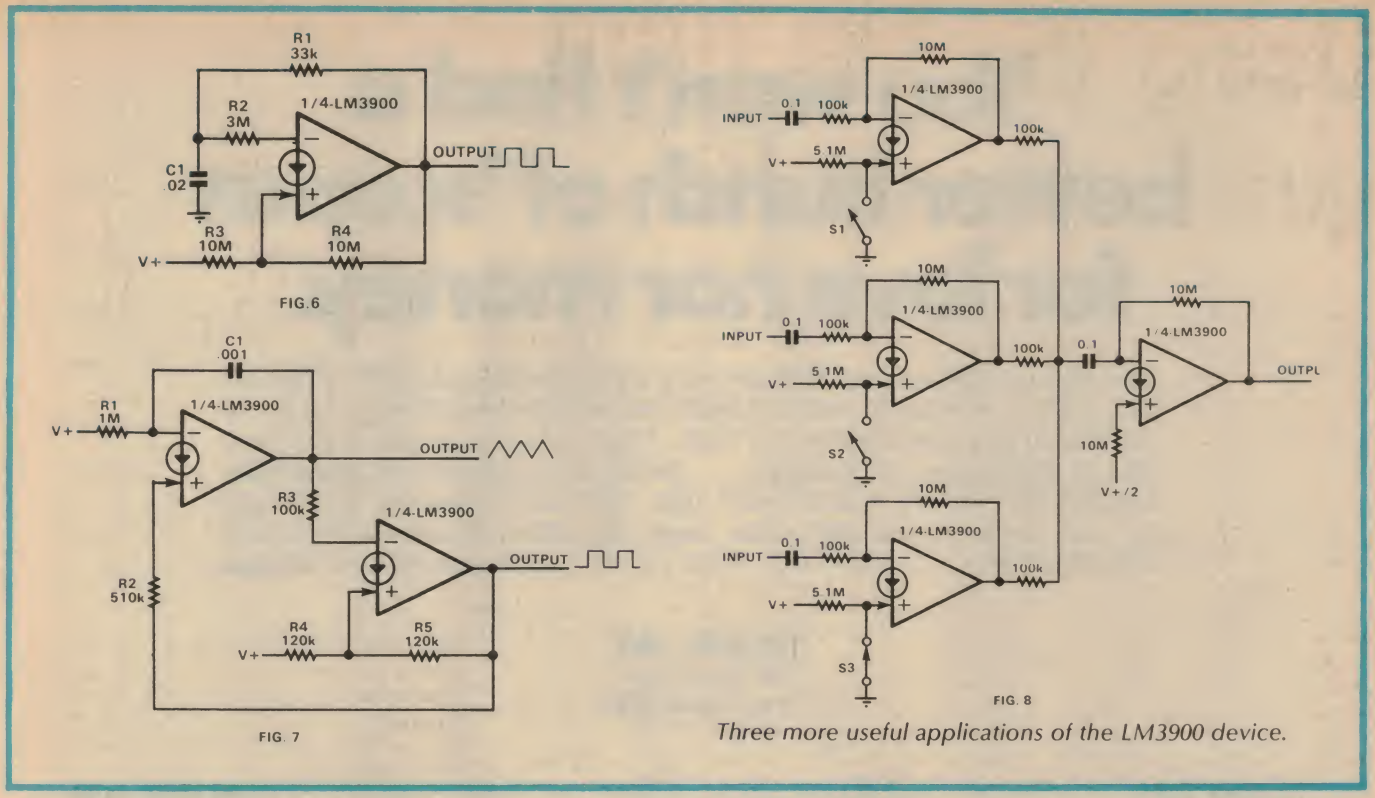


FIG. 5

Three simple amplifier configurations using the LM3900 quad op-amp device. At top left is a basic inverting amplifier, with a non-inverting amplifier below it for comparison. Above is a DC coupled power amplifier using a Darlington pair at the output.



Three more useful applications of the LM3900 device.

be half that of the positive supply line, the valve of R3 should be twice that of R2. However, the value of R3 can be selected to provide any quiescent output voltage within the device range. The gain-bandwidth product is 2.5MHz for the Fig. 3 circuit.

The effect of power supply hum can be greatly reduced by returning R3 to a decoupled supply. For example, one may employ a value of R3 equal to R2 and return R3 to a decoupled supply of V+/2.

A non-inverting amplifier is shown in Fig. 4. The gain is R1/R3, or 100 with the values shown, and this gain can be obtained up to 1MHz. R2 and R3 should be equal for a quiescent output voltage of half the supply voltage. The lower end of R2 may be connected to the junction of two 47 kilohm resistors which are connected in series across the supply lines; this junction should be decoupled with an electrolytic capacitor. This decoupled supply may be used to supply any reasonable number of amplifier stages.

In the circuit of Fig. 5 the LM3900 amplifier output is fed to a high current Darlington amplifier. The output transistor should be mounted on a heat sink, in which case output currents of over 3A can be obtained.

Square Wave Generator

In the circuit of Fig. 6, the capacitor C1 alternately charges and discharges via R1 between voltage limits which are set by the other resistors. The circuit is basically a form of Schmitt trigger which, with the values shown, produces a square wave output of frequency about 1kHz.

The circuit of Fig. 7 employs two of the LM3900 amplifiers to generate square and triangular waves simultaneously. The amplifier on the right hand side operates as a Schmitt trigger circuit, whilst the other amplifier operates as an integrator. If R1 = 2R2, the waveforms will be symmetrical. The frequency is inversely proportional to C1 and R1.

Audio Mixer Unit

Fig. 8 shows the use of the four amplifiers of an LM3900 in an audio mixer unit. The amplifier on the right hand side sums the outputs from the other three amplifiers. When the switches S1 and S2 are in the open position (as shown), the current flowing through the 5.1M ohm resistors will saturate these amplifiers and only the third input will contribute to the output signal, S3 being closed.

Conclusion

Many further applications of the very versatile LM3900 quad op-amp device are given in the National Semiconductor Application Report AN-72; they include voltage regulation, active filters, staircase waveform generators, digital circuits, tachometers, voltage controlled oscillators, etc.

The LM3900 is available from most suppliers, including Dick Smith Wholesale Pty Ltd, 160-162 Pacific Highway, Gore Hill, NSW 2065.

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RF dummy load

Here is a very useful accessory for the radio amateur. Although easily built up in a couple of hours, it can be almost invaluable when testing transmitters. If you're a Novice just starting to equip your "shack", it would be well worth building.

by IAN POGSON

It is necessary sometimes to make prolonged tests on an amateur radio transmitter, and as the regulations do not allow a transmitter to be fed into a radiating aerial for such tests, it becomes necessary to use an "artificial aerial", "dummy aerial", or a "dummy load". All three names mean the same thing in this context. They describe a device which when connected to a feedline from the transmitter, looks the same as a properly adjusted aerial system. Ideally, this will be a pure resistance, in the range 50 to 75 ohms and capable of dissipating the full amount of RF power output from the transmitter.

If the power to be dissipated is only 10 watts, or even less, then the traditional way of producing an economical dummy load is to use 12 or more 1 watt non-inductive resistors connected in a series-parallel arrangement. For power ratings up to 100 watts or so, a suitable number of larger resistors similarly connected, to give the required 50 or 75 ohms, can be a satisfactory arrangement.

The power dissipation capability of a dummy load can be increased quite markedly by immersing the resistive elements in a suitable oil. It is also possible to add a metering circuit across the dummy load to measure the actual amount of power being dissipated by the load, which also corresponds to the power output from the transmitter under test.

An alternative type of dummy load is one which uses a resistive element specially designed for the job. An example of this is a 50 ohm, 50 watt resistor imported by Dick Smith Electronics Pty Ltd. This resistor is in the form of a ceramic tube, with the element deposited on it and with about 12mm at each end metal sprayed to allow contact to be made. There are no signs of spiralling and the type of construction should result in a resistor with very low inductance. Made by Sankyo Tokusyu Musen, of Japan, it is designated the "Erema type SP".

Having acquired the resistor, the question arises as to how best to arrange it for use as a dummy load. Possibly the most convenient form is to mount the element in some sort of metal enclosure. This makes it easy to handle and it also gives a considerable amount of shielding, which will further reduce the possibility of radiation. While this arrangement also reduces the heat dissipation if the element is simply mounted "in air", it also makes it possible to immerse the heat element in oil and this more than offsets the former disadvantage.

We solved the problem of a suitable container by raiding the kitchen cupboard, coming up with an empty "Ovaltine" tin. This tin which has a press-on lid, is about 98mm in diameter and 120mm high. This turned out to be just high enough to give sufficient end clearance to the resistor and mounting arrangement. While the diameter is perhaps a little more than necessary, it allows for a good quantity of oil if it is used, and the power dissipation will be increased accordingly.

A one litre paint tin should also be suitable—but choose one which can be cleaned out. A water-based plastic paint would be a good choice, allowing the tin to be cleaned out very easily.

The way the problem of mounting the resistive element was solved may be seen from the picture and the drawing. Unless you have ideas of your own, we suggest that you follow the method used in the prototype. This is how we did it.

Basically, there is a clamp at each end of the element. Each clamp consists of two parts as shown in the drawing. The blank size of each piece is 48mm long and 13mm wide. Each piece is bent up as shown, using the end of the resistor to obtain the correct radius. The clamps are then screwed to the resistor and the other pieces made and soldered to the clamps.

Our clamps and other pieces were

Shown in these pictures is the 50-ohm dummy load, using a single 50-watt load resistor made by Sankyo Tokusyu Musen in Japan. The tin provides shielding and holds cooling oil, if this is used.

RF dummy load

made up from pieces of tinplate, salvaged from another tin. This is cleaned up and the pieces are cut out with a pair of tin snips. If you are lucky enough to have access to some thin sheet copper or brass, then this may be used instead of tinplate.

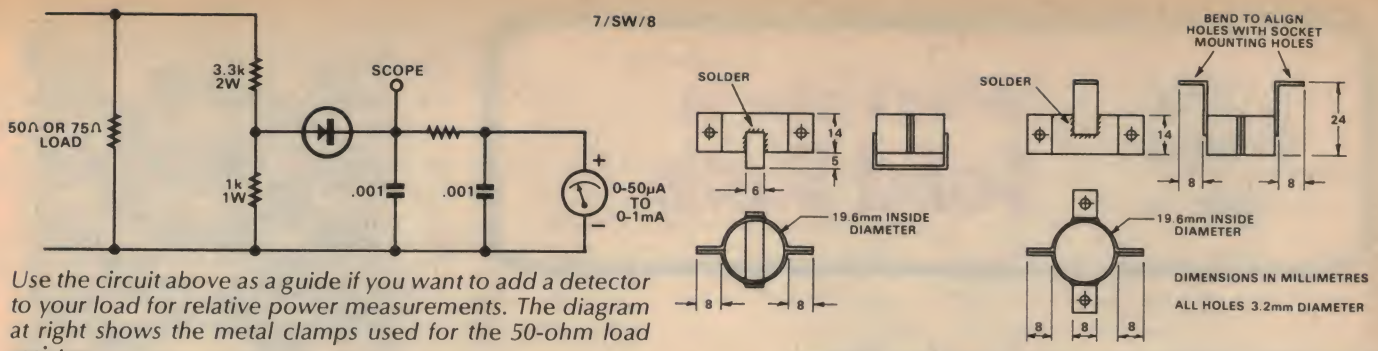
The type of coaxial socket which you use will be up to your own preferences; no doubt one which you have standardised on for all coaxial connections. The socket is fitted to the lid of the container and the resistive element mounting brackets can hopefully make use of the same screws.

Prior to finally mounting the element assembly, a lead must be provided to run from the centre terminal of the socket, to the far end of the resistor. This lead may be a stout gauge of tinned copper wire but the inductance of the lead may be reduced by using either a strip of copper, or this may be simulated by soldering together three or four pieces of 18 or 20 gauge tinned copper wire to form a flat strip.

The assembly, fitted into the container, is at this point, the basic unit and may be used as a dummy load on small transmitters such that the dissipation can be handled comfortably. On the other hand, if you want to take it further and to handle higher power, then further work must be done to make it suitable for oil cooling.

A hole is drilled in the lid, alongside the socket, to clear a screw about 4BA size. A nut is soldered to the outside of the lid and over the hole. With a screw in this nut, the arrangement is a simple pressure-relief device. To reduce the possibility of oil leaks to a minimum, solder around the coax socket. Joints of the tin should be filled with a run of solder. The inside of the tin should be clean and make sure that all soldering resin is removed. Methylated spirit may be used for cleaning.

By now, you will be asking what kind of oil to use. Perhaps the best choice would be transformer oil, if you are able



Use the circuit above as a guide if you want to add a detector to your load for relative power measurements. The diagram at right shows the metal clamps used for the 50-ohm load resistor.

to obtain a small quantity. On the other hand, when we described a dummy load way back in May, 1967, we suggested that Castrol Z10 could be used. We have just been in touch with Castrol and they advise us that the Z10 is no longer available. However, they suggest that an alternative may be Castrol TQ (Dexron), which is an automatic transmission fluid. We have not tried it at this stage, but it seems to be a good possibility.

Quart packs of Castrol TQ (Dexron) may be obtained from Repco Auto Parts Pty Ltd, Grace Bros, and possibly other automotive houses.

The idea of using light motor oil should be approached with caution, as the additives may adversely affect its use for our purpose.

If it is your intention, now is the time to fill the container with oil to a level that will cover the resistor body, making sure to leave some space for expansion. When the lid has been fitted and when satisfied that all is well, it is a good idea to fix the lid with a couple of blobs of solder. This will prevent the lid from being accidentally removed, with possible unpleasant results!

So far, we have only considered the needs of those who use a nominal 50 ohm transmission line system. What about those who have settled for a 75 ohm system? Unfortunately, the answer to that one is that no 75 ohm resistor is available similar to the 50 ohm one just discussed. There is an alternative of course and this was touched on at the beginning of this article. The well tried idea of placing a number of resistors in parallel between two plates, or other similar conductors, can be put to good use where a 75 ohm system is required.

A 75 ohm dummy load along these lines was described in May, 1967 and to make the treatment complete, we will repeat brief details of this unit. Unfortunately, the availability of suitable resistors has changed considerably in recent times and it will be largely up to each individual to find resistors which will suit the particular application.

Using our former prototype as a guide, using seven 8 watt resistors, to obtain 75 ohms it may be arrived at by using three 470 ohm resistors in parallel with four 560 ohm resistors. This gives just under 74 ohms, which is close enough for most purposes. Resistors of the above values and rate at between seven and ten watts should meet most requirements—in air for lower dissipation requirements and immersed in oil for higher power.

The picture shows a typical dummy load. This one was made up for ordinary high frequency use but if you wish to use one into the VHF range, then it would be wise to keep lead lengths as short as possible and to use a metal plate at the end, rather than radial leads.

Now that we have a dummy load, it is possible to extend its use beyond that whereby it is simply used to dissipate power from a transmitter. By adding some extra circuitry and components, it is possible to obtain an indication of relative output from the transmitter, as indicated on a meter. Furthermore, if one goes to the trouble to calibrate the instrument in terms of voltage across the load, the power output from the transmitter can be readily arrived at. And if the load is to be of a constant value (either 50 ohms or 75 ohms) then the meter may be calibrated directly in terms of power.

As a guide, a suggested circuit is given. Because small signal diodes are somewhat limited in their reverse voltage rating, this restriction may be overcome by placing a voltage divider across the load. The value of the divider is high compared with the load resistance and so it may be disregarded as far as its effect on the load resistance is concerned. For HF and VHF up to about 150MHz, an ordinary germanium diode, such as the OA91 may be used as the rectifier. For higher frequencies, a hot carrier diode should be used. The series resistor in the filter and metering circuit should be a value such that full scale reading is not exceeded under likely maximum power conditions. With these criteria met, the meter will give relative readings of output power.

If you wish to calibrate the meter in terms of RF volts, then perhaps the most convenient method for the average person would be to calibrate it against a known AC voltmeter, at 50Hz. The two .001uF capacitors should be increased temporarily to 1uF or higher and the series resistor may be adjusted to give a full scale reading when 100V AC is applied. The extra capacitors should be removed after this operation.

Still another application is available. At the point marked "scope", an oscilloscope may be connected. This allows the modulation envelope to be checked, so that you can make sure your signal is clean and linearly modulated.

If you need or want a 75-ohm load, this is still the way you'll need to build one. Use a number of suitable power resistors, connected like this for low inductance.

What's new in Solid State

Very flexible timer IC, active filter

First item this month is an LSI timer device which uses digital counting to provide precise long-period time delays. Known as the LR171E, it is made by a firm called Elremco in Essex, UK. Apparently it has been designed both for industrial process timing and for domestic use in washing machines, cars, battery chargers and similar applications.

The circuit for the LR171E is shown below. Essentially it consists of an RC clock oscillator whose frequency is set by external components Ct and Rt, and whose output is fed to a digital counting chain consisting of 12 flip-flops. Logic circuitry detects when all FFs have been set (after 4096 clock periods), and provides an output signal at pins 3 and 4. Time periods up to 24 hours are readily obtained.

movement, to give convenient display of lapsed time during the timing cycle.

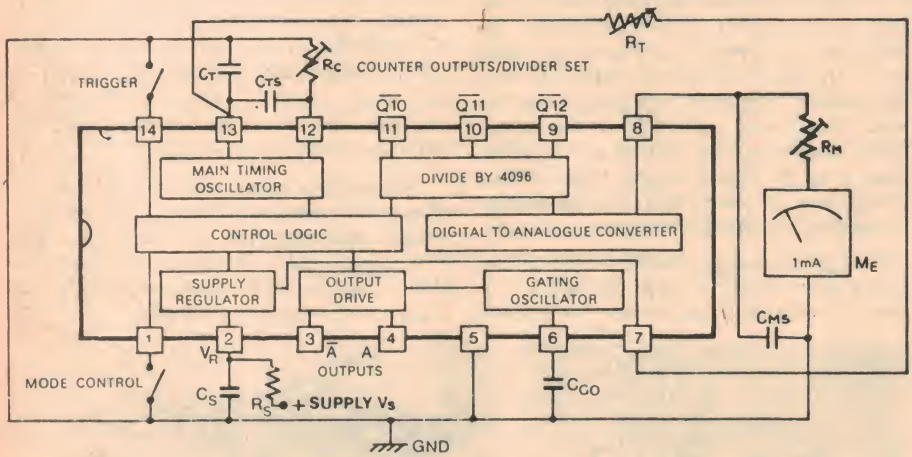
The LR171E has its own internal supply regulators, and will operate from voltages anywhere between 6 and 450V DC merely by changing the series resistor value.

Triggering of the device may be from switch contacts, TTL gates, an LDR or any similar source. The device is readily protected against noise for operation in industrial environments.

Suggested applications for the LR171E are for automatic battery chargers, and for control of parking lights, headlights, and windscreen wipers in cars.

Local agents for Elremco are A. J. Ferguson Pty Ltd, of 29 Devlin Street, Ryde, NSW.

Another interesting new IC is a device



The Elremco LR171E timer IC, which is capable of providing precision timing periods of up to 24 hours duration, simply and at low cost.

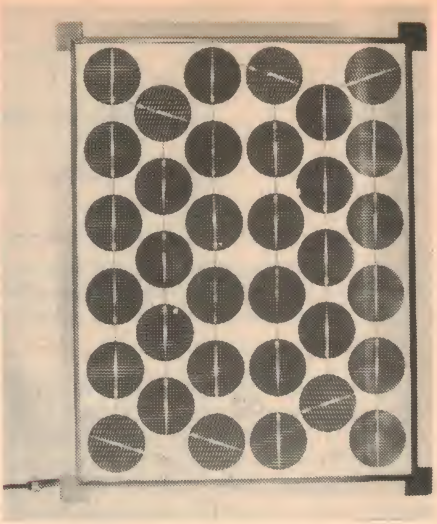
To this basic system are added a few frills, which provide additional facilities. The Q-bar outputs of the last three FFs in the counting chain are brought out at pins 9, 10 and 11, and this allows subdivision of the basic time period into T/8 segments. This also allows sequencing, by means of an external decoder. An inbuilt gating oscillator controlled by pin 6 also allows the main outputs to be pulsed, for direct triggering of Triacs and SCRs.

An internal D-A converter connected to the last 6 stages of the counter chain provides a staircase current output at pin 8. This is suitable for driving a 1mA meter

from National Semiconductor which they describe as a "universal active filter". Designated the AF100, it is available in either a 14-pin DIL or a 12-pin round metal can package.

The device contains four internal op amps, connected in such a way that they can be programmed for any of the classical second order filter configurations with only four external resistors. Low, high and bandpass functions are available simultaneously at separate outputs. Higher order filters may be realised by cascading a number of AF100 devices.

Only brief information has been given for the device at the time of writing, but



Philips Elcoma has released an improved version of its solar cell array, this BPX47A. Changed construction gives it a higher efficiency and 10.7W output at 25°C.

it will apparently operate to 10kHz with a realisable Q range to 500. Power supply range is from ±5V to ±18V, and the frequency accuracy is quoted as 1% unadjusted.

Another new device from National is a precision reference IC, the LM199, which they claim to be 20 times more stable than zener diode references.

Basically the LM199 consists of a zener derived reference circuit on the same chip as a temperature control circuit. The latter operates from between 9 and 40 volts DC, and dissipates ony 300mW.

The zener element in the reference circuit of the device is a subsurface breakdown type, in which breakdown is forced to occur well below the chip surface. This eliminates the surface-related instabilities that plague other zeners.

The performance specs of the LM199 are very impressive. Long term stability of its nominal 6.9V output is .002%, with drift less than 1ppm/°C. The zener output impedance is half an ohm, making it two orders of magnitude less sensitive to operating current than a standard 7.5V reference zener. A 1% change in operating current at 1mA changes the voltage by only 5uV, compared with about 1200uV.

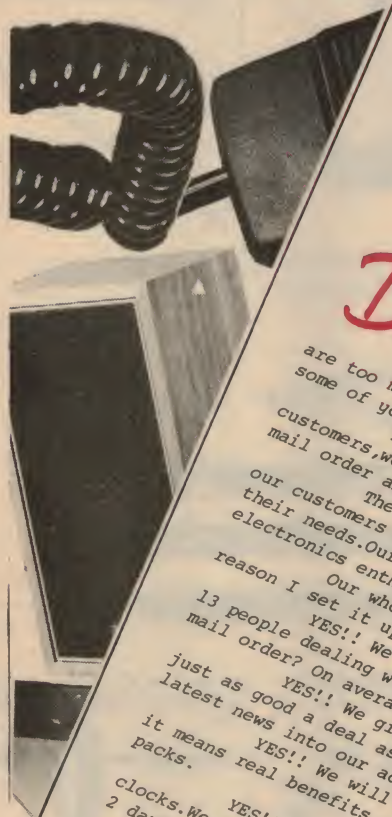
The LM199 comes in a four-lead TO-46 hermetic metal package. Price of the premium device is around $35 in 100-off quantities, but an industrial grade version called the LM399 is available for around $3.25 in similar quantities.

Applications for the LM199 include a standard cell replacement, a precision clamp and a portable calibrator.

National Semiconductors are available locally from NS Electronics Pty Ltd, cnr Stud Rd and Mountain Hwy, Bayswater, Vic. (J.R.)

For further data on devices mentioned above, write on company letterhead to the firms or agents quoted. But devices should be obtained or ordered through your usual parts stockist.

DICK SMITH
Mini Catalogue
Christmas 1975



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YES!! We will continue selling individual items. We avoid prepackaging unless it means real benefits to you - as in our computer selected resistor and capacitor packs.

YES!! We're still looking for new ideas. We crashed the price of digital clocks. We almost gave away transistors. Our special offer packs in E.A. lasted just 2 days. To satisfy the mail orders we had to negotiate for enormous extra quantities.

YES!! We're project orientated. We co-operate with magazines to get the parts you need, we try to help them with helpful suggestions. We often have to search for substitutes.

YES!! As a service to our growing number of professional customers we have installed a Telex for your convenience. We also now have a special Tax-Free price list.

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NEW TOOLS

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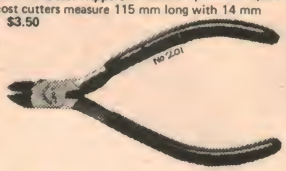
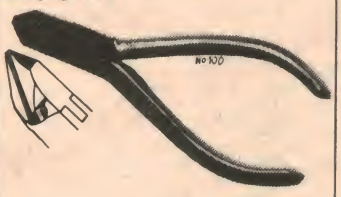
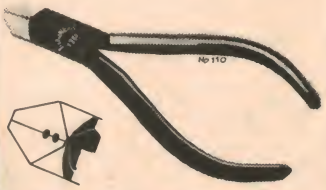


No. 200 Cutters Large rivet joint to prevent twisting. Fine sharp edges with smooth cutting side. Measure 125 mm with 18 mm cutting edge. **$4.20**

No. 100 Diagonal Cutters Feature box joint for more rigid support of the jaws which won't twist or distort. Very fine, sharp and keen cutting edge. Perfectly forged and tempered. Measure 125 mm with 22 mm cutting edge. **$4.75**



No. 110 Diagonal Cutters Box joint. Cutting edge has two handy wire stripping holes (1.2mm and 1.6mm dia) 125 mm long with 22 mm jaws. **$4.50**



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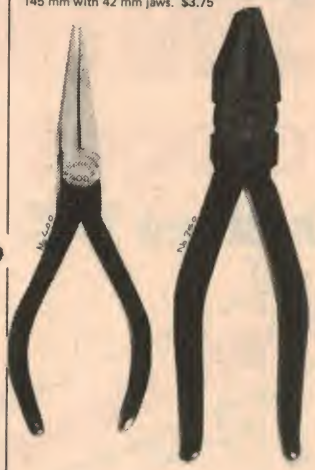

No. 350 Side Cutting Pliers For linesmen or general use. High quality gunmetal. Polished finish. Flat serrated jaws with wire cutters. 155 mm long with 25 mm jaws. **$3.75**

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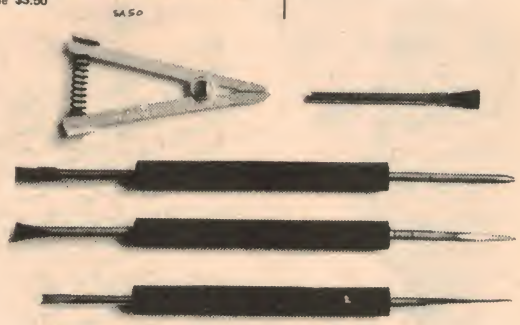

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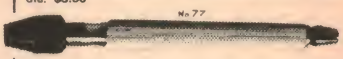
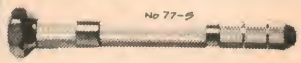


No.77–5 Pin Vice Chrome plated with double ended chuck and 3mm capacity **$4.00**



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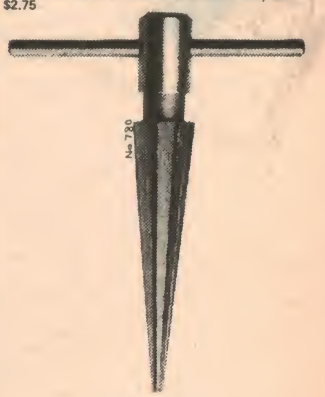

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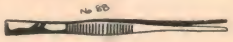

DICK SMITH

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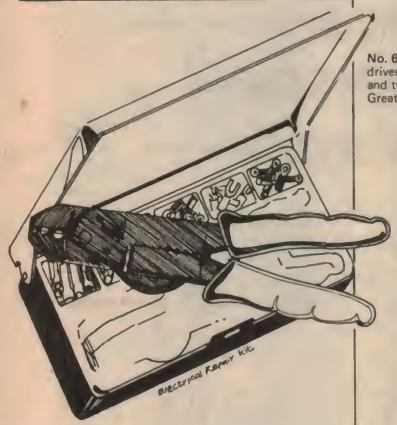

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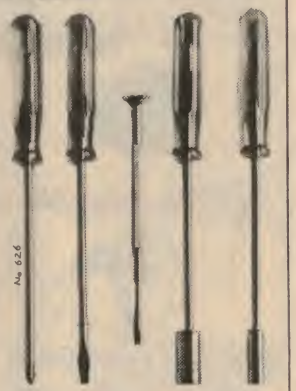
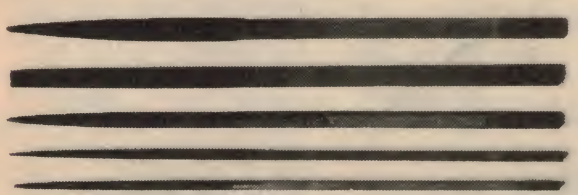
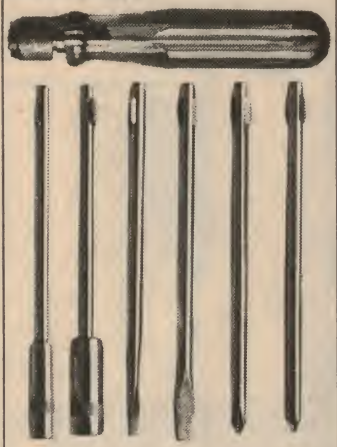


EL–1 SOLDER SUCKER Full metal construction – better than plastic!! With Teflon tip. Simple push/release thumb mechanism. Complete with nozzle-sweeper.(!) Only **$7.50** (Spare Teflon Tips **$1.50**)



No 705

No. 516 Screwdriver Set Chuck type handle takes 6 'bits' Vinyl case. 3 and 5 mm screwdrivers. 2 sizes of Philips, plus 2 spirit lights 6mm and 8mm A.F. A handy set eh? **$2.75**



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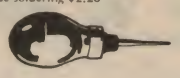

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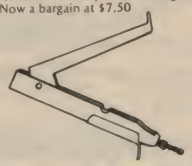

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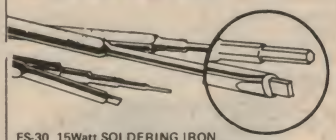
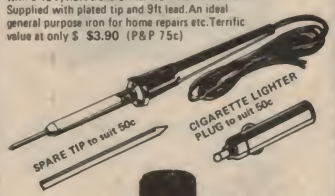


FS-30 15Watt SOLDERING IRON
This beaut little iron operates from any 12V supply. Yes ac or dc - so you can use it in the car or boat,or with a 12V,1.2A transformer from domestic mains. Supplied with plated tip and 9ft lead.An ideal general purpose iron for home repairs etc.Terrific value at only $ **$3.90** (P&P 75c)

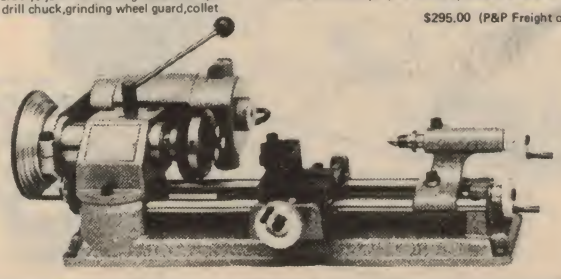


MINIDRILL
PC DRILL runs off 4 UM3 cells or 6V d.c. at 600mA runs at 2500 rpm drilling holes from 0.0236 to 0.059" Ideal for all PC drilling, model makers, jewellers. This is a new line at $15.75 (p&p 75¢)

And now . . . .
STD-50 MINIDRILL STAND
Make your own Mini Stand Drill. Only $8.50 (p&p 75¢)

UNIMAT MINIATURE MACHINE SHOP
What more could you need with the range of fantastic tools included with this machine? Complete kit includes: 240V,95W motor with a speed range from 365 to 6000rpm.Faceplate. driving dog,vertical miling,drilling,surface grinding grinding arbor,3 jaw self-centring lathe chuck,¼" capacity drill chuck,grinding wheel guard,collet holder and 5 collets from 1/16 to ¼".Also included is a set of tools,drills,milling cutter,lathe tools,counter sink bitand grinding wheel.PLUS 43 page techniques handbook.
By offering this complete kit you make a saving of around $20 on the tools.Highly recommended for the serious hobbyist,constructor,modelmaker etc.

$295.00 (P&P Freight on)

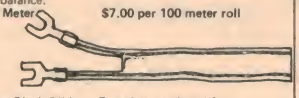


Mini-Catalogue

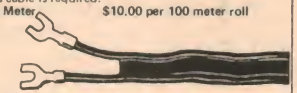
TV. Accessories

T.V. RIBBON AND CABLE

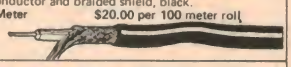
TV Ribbon and Cable 300 ohm clear ribbon – designed for indoor applications – very low loss – maintains per perfect balance.
10¢ per Meter $7.00 per 100 meter roll



300 ohm Black Ribbon Especially designed for outdoor applications and long runs where an extremely low loss cable is required.
13¢ per Meter $10.00 per 100 meter roll



75 Ohm Coaxial Cable 3C2V This cable is designed for for television feeder systems. Excellent dielectric and suitable for use up to 400 MHz. 5/16" diameter, solid centre conductor and braided shield, black.
30¢ per Meter $20.00 per 100 meter roll

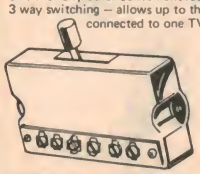


300 OHM (Twin Ribbon) ACCESSORIES

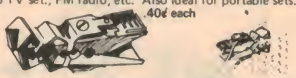
N9022–5029 4 Set Coupler Handles colour, black & white, and FM signals with minimum loss of signal strength even when all 4 sets are operating at the same time. Compact plastic case can be mounted at any location near antenna lead in. 300 ohms input output impedance. $3.50

N9021–5028 Same as above but for two sets only $2.50

N5228 3 Way Antenna Switch Attaches to the back of TV or any other convenient location. Gives instant 3 way switching – allows up to three antennas to be connected to one TV or FM set. $3.50

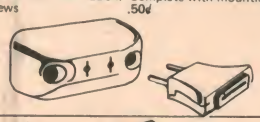


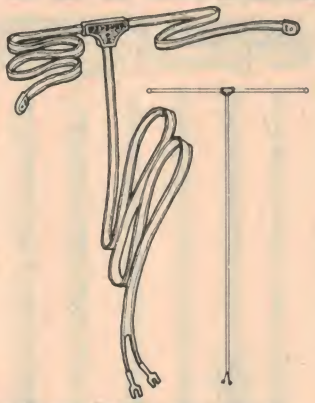
N1015 TV Antenna Clip Strong plated springs with screw terminals and coloured plastic handles. Quick way to connect or disconnect antenna lead-in wires to TV set., FM radio, etc. Also ideal for portable sets. 40¢ each



N4695–9068 AM/TV Splitter The useful unit splits the incoming signal on a standard 300 ohm TV lead and gives 3 different outputs TV–VHF, TV–UHF and FM. This is the ideal unit for the person who wishes to operate his FM tuner from the normal TV aerial. $3.50

300 Ohm plug and socket set designed to mount on wall or skirting board – for professional connection of 300 ohm twin ribbon. Complete with mounting screws 50¢





N10020 Indoor FM Antenna 300 ohm dipole FM antenna brings in good signals in all local areas. May be placed behind set, or hidden out of sight. Moulded ends make mounting easy. Long hook up lead terminates in spade lugs for simple hook-up to set. $1.00

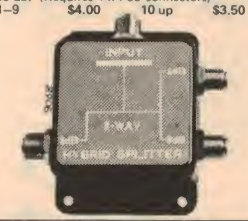
75 OHM (Coaxial Cable) ACCESSORIES

9066 Set Balun High quality, low loss ferrite balun for converting 75 ohm coax impedance to 300 ohm set impedance – designed to be mounted at rear of TV or FM set. Completely shielded and balanced. Also features AC blocking.
1–9 $2.00 10 up $1.50
(Requires one F59 connector)

9052 Weatherproof Aerial Balun Designed for indoor (TV set) or outdoor (aerial) mounting. This matching transformer converts from 75 ohm coax impedance to 300 impedance. Completely moulded construction and is supplied with rubber boot for weatherproof operation.
1–9 $2.50 10 up $2.00
(Requires one F59 connector)

9067 Two Way Hybrid Splitter This compact splitter provides two 75 ohm outputs from one 75 ohm input. Designed to provide two outlets from one TV aerial. Passes AC/DC power. Frequency response 5 to 300 MHz VSWR 1.3:1, insertion loss 3.5 DB, isolation 30 db.
1–9 $3.00 10 up $2.50
(Requires 3 x F59 connectors)

9068 Three Way Hybrid Splitter Designed to operate up to 3 TV sets from the one aerial. 75 ohm input, 3 75 ohm outputs, passes AC/DC power. Frequency responses 5-300 MHz, insertion loss 5 db isolation-30 db. (Requires 4 x F59 connectors)
1–9 $4.00 10 up $3.50



9069 Four Way Hybrid Splitter Four way 75 ohm VHF/FM/TV hybrid splitter provides four separate 75 ohm outputs from one 75 ohm input. Passes AC/DC power. Frequency response 5 to 300 MHz insertion loss 8 db isolation 30 db.
(Requires 5 x F59 connectors)
1–9 $4.50 10 up $4.00

Coaxial Connectors & Adaptors For all coaxial TV connectors we recommend the range of "F" type connectors. New to Australia these connectors are standard in many overseas countries including the USA. Their greatest feature is the fact that they require no soldering. When used with standard "3C2V" solid conductor – coax cable this connector retains a very high VSWR – far higher than normal connectors using screw terminals.
They can also be easily connected and disconnected without the necessity of tools. This type of connector can only be used with solid centre conductor coaxial cable.

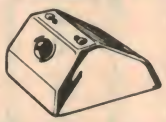
F59 Male Cable Connector For use with 3C2V and RG59/U cable. Mates with F61A and F81 connectors and all our series of splitters. Supplied with separate female for cable coupling.
1–9 30¢ 10 up 25¢

F61A Female Chassis Fitting Accepts F59 connectors Mounts in 3/8" diameter hole. Supplied with nut and washer.
1–9 35¢ 10 up 30¢

F81 Female Adapter Mates with F59 connectors. The ideal way to connect lengths of coax without soldering and while retaining low VSWR.
1–9 50¢ 10 up 45¢

Lightning Arrestor 75ohm/300ohm This lightning arrestor mounts on the mast near the aerial. Suits all types of lead-ins – coax, twin lead, etc. May be used indoors or outdoors. Simply run lead along arrestor and tighten screws – no soldering necessary.
1–9 $2.50 10 up $2.00

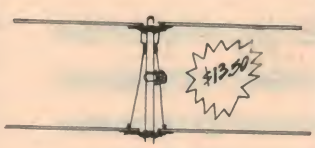
75 OHM OUTLET
Surface mounting Co-Ax outlet suitable for up to 850 MHZ. Ivory plastic case. $1.50



LOW COST CONNECTORS

Handy Insulated Coaxial Connectors
Moulded in tough, black plastic for TV, radio and instrument use. 75ohm.

		1-9	10up
Line plug	COP1	35c	32c
Chassis socket	COS2	50c	40c
Cable/Panel joiner	COS5	50c	40c

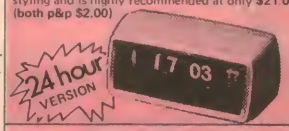


F.M. ANTENNA
The latest VHF/FM aerial. Suitable for both vertical or horizontally polarised signals. A must for good FM reception. Mounts indoors or outdoors. Mast extra. $13.50 (P&P $1.50)

NEW

COPAL DIGITAL CLOCKS
The Copal range is a beaut new way to tell the time. Copal celebrated their 25th Anniversary last year and have a world wide reputation for precision engineering. They introduced digital clocks in 1965 and manufacture 200,000 clocks a week!! We've chosen the **RP 160** – the lowest price alarm clock in their range with a 12 hour digital presentation and 24 hour alarm dial. Colours are ivory, orange and gold and price is well under normal retail at **$14.50**

Model 703 is for Amateurs and features a 24 hour display and a repeater type alarm. Available in orange, avocado or white. This clock features ultra-modern styling and is highly recommended at only **$21.00 (both p&p $2.00)**



NICAD BATTERY CHARGER
This neat little unit is made by Sanyo and charges all three 1.2V NiCad cells AA,C & D. It is used in conjunction with a 6V battery eliminator (included in the price) which enables many pieces of battery equipment to be mains operated as well!! Charges up to 4 cells at a time. Charge rate is 36mA or 73mA @ 2.4V (2 cells of any type at a time). Unit has charge indicator and see-thru lid. Measures 58×100×195mm. We've yet to see a simpler, better unit for **$24.95 (p&p $1.00)**

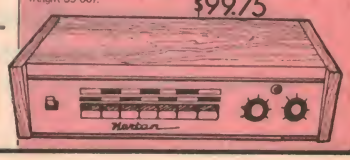
FANTASTIC LOW PRICE RHYTHM UNITS
Ideal for groups etc. wanting to add that extra rhythm dimension. Simply plug into high impedance input of your amplifier

RF5 CONCERT RHYTHM BOX
Provides slow rock, latin beat, rock'n'roll, foxtrot and waltz, at push of button. Produces sound of Drum, Conga, claves, maracas, cymbal and snare drum. Tempo control continuously adjustable – volume control and start switch. 15 transistor 27 diode circuit. This sort of unit could cost you $90, but our direct import price is only $57.00 (P&P Road Freight $3.00)

$57.00

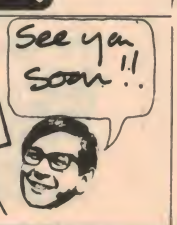
RH12 NORTON RHYTHM BOX
Must be the ultimate, giving a choice of 12 rhythms – March, Foxtrot, Rock, R & R. Ballad, Shuffle, Bossa Nova 1 & 2, Latin, Mambo, Waltz, Jazz Waltz. "Instruments" include bass drum, high range, snare drum, claves, high hat. Has tempo and volume controls and start switch. Pilot light flickers in time with beat. Circuit has 22 transistors and 50 diodes. You must hear one to realise potential and incredible value. Beaut timber finish. Why pay up to $140 for the sound the RH12 gives you for only $99.75 (p&p road freight $5.00).

$99.75



LATE NIGHT OPENING!

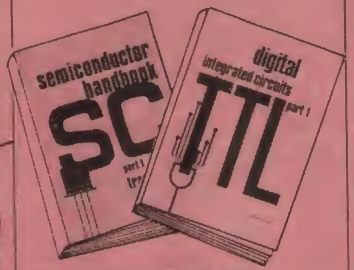
We are now open on Thursday evenings until 8 p.m. at our GORE HILL Centre (ONLY UNTIL CHRISTMAS)



DICK SMITH

PRODUCTS

LATEST BOOKS



TRANSISTOR EQUIVALENTS, 9th edition, entirely revised and extended, 312 pages. $4.90 p&p 50c. This reference book enables the user to find substitutes for given transistors. To this end approx. 9,500 transistor types of European, American and Japanese make have been included together with equivalent substitutes.
As it is very rare that one can speak of real substitutes or "equivalents" for given transistors it is recommended to check the detailed features of the chosen substitute by consulting its full specifications in the "SEMICONDUCTOR HANDBOOK, Part 1, Transistors."

DIODES EQUIVALENTS, 1st edition, 144 pages $3.75 p&p 50c. No less than 9024 equivalent types for close to 6100 given diodes of European, American and of Japanese origine have been included in these tables triacs, diacs, leds, thyristors, light-sensitive and luminous semiconductors, with the exception of phototransistors.

THE WORLD'S RADIO BROADCASTING STATIONS, 1st edition, 200 pages $6.90 p&p 50c. This book will serve as an up-to-the-minute guide for shoe who are interested in DX-ing.
Of all the world's broadcasters on SW, MW and LW, – and of the European FM/TV stations also –, full details have been compiled in an efficient arrangement. No detail has been left out!
Additional all-over information for beginners in English, French, Spanish, German and Dutch will contribute to a wider comprehension of the art of DX-ing. A real Golden Guide for listening in to the World!

SEMICONDUCTOR HANDBOOK, PART 1, TRANSISTORS, 1st edition, 164 pages $6.90 p&p 75c. This manual includes over 108.000 details of 6.750 current transistor types of European, American and Japanese manufacture. Of each transistor type the mechanical and electrical features have been given including diagrams of transistor cases.
For easy reference the details have been arranged in alphabetic numerical classification. This reference work offers a comprehensive source of indispensable information about current transistor types.

TTL-DIGITAL INTEGRATED CIRCUITS 1, 1st edition (series 7400–74132), 172 pages $7.50 p&p 50c. NEW! Recording complete data and essentials of Digital Integrated Circuits, – series 7400 – covering 13 principal manufacturers in USA and Europe, this directory provides an **all-in-one** survey of details including equivalents.
Filed in numerical order and indexed for easy reference this vast directory has been planned as an efficient and practical working tool for both professionals and students in electronics. The editor has, in compiling this work, drawn on his practical experience in this particular and specialistic field.

ELECTRONIC TUBE HANDBOOK, 16th edition, 440 pages. $6.90 p&p 75c. This book covers the principal data of a large number of European and American types of receiver and amplifier tubes as well as of cathode ray tubes for television sets and oscilloscopes.
The data have been arranged in such a way that all relevant characteristics and electrode connections of a given type can be found easily.

PIN-POINT TV TROUBLES – IN 10 MINUTES. 342 pages. $9.65 (p&p $2.00).
The guidance in this handbook enables you to find rapidly the location of most breakdowns and then go on to pinpoint a faulty valve or component.
A popular seller.

SEMICON INTERNATIONAL TRANSISTOR DATA MANUAL. 400p. $28.00 (see E.A. April 75)
Jim Rowe called it "a most thorough reference ... worthy worthy of a place in any lab or service shop" Yes, it is expensive, but then is lists some 24,000 devices.
Check the contents:
- Introductory definitions, codes and symbols.
- Manufacturers' names and addresses.
- Alpha-numeric listing of transistors and FET's.
- At least a dozen spec's for each device.
- Quick substitution guide.
- CV (M.I.L. spec) guide substitutes.
- Termination drawings etc. etc

PLUS . . . You mail them a card and they GUARANTEE to send you a year's worth of update information as it becomes available. So it isn't a book, it's a service too!! Similar publications cost over $60.00. Semicon is yours for **$28.00**

STUDENT EDITIONS

ELECTRICAL AND ELECTRONIC DRAWING, James F. Lowe – 145 pages, $5.00 (p&p $1.00). Written by an Australian for Australia, this book is an introduction to drawing and provides an understanding of mechanical and technical drawing. Coming with a set of questions and exercises, this text fulfils the needs of Electrical and Electronic Trade and Post Trades Students doing First Year Drawing.

EXPERIMENTS IN ELECTRONICS. James F. Lowe – 111 pages, $3.50 (p&p $1.00). A practical laboratory manual suitable for either advanced or basic courses. Experiments are graded into three levels – basic, standard and advanced and are designed to use equipment in Australian Technical Colleges.

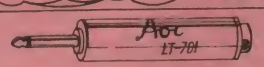
ELECTRIC AND MAGNETIC CIRCUITS. A. Mychael – 256 pages, $6.95 (p&p $1.20). Suitable for Certificate and Technician students in electronic and electrical engineering, the text gives a grounding in the techniques of solving magnetic and electronic circuit problems.

SERVICING THE SOLID STATE CHASSIS. H. Davidson, 256 pages. $5.35 (p&p $1.50). A practical approach to the techniques of solid state troubleshooting which avoids the theory and maths and gets down to plain fault-finding.

BASIC ELECTRONICS. Bernaud Grob – 800 pages, $13.95 (p&p $2.00) This International student edition presents the basics in electrical principles, valves and transistors with a practical approach. Each chapter ends with a summary, review questions and problems.

101 TV TROUBLES SYMPTOM TO REPAIR. A. Mangolis, 224 pages. $5.85 (p&p $1.50). An all-inclusive guide to the cause and cure of 101 TV troubles – colour and B&W, all mapped out in plain language. Each chapter lists virtually every possible cause of a specific malfunction.

INTRODUCING ELECTRONICS. E. R. Jones – 45 pages, $2.00. (p&p $2.00) Essentially a practical approach, this book, published in Australia, covers the basics of electronics and is ideal reading for the electronic beginner.



LT701 MICROPHONE LINE TRANSFORMER
Input is low impedance 100-250Ω. Output is high impedance 50k. Fitted with manual jack type plug and socket (looks like a bug jack plug!!) so very easy to instal. Fully shielded metal construction. **$5.90 (p&p 75c)**

LATEST PRINTED CIRCUIT BOARDS

ETI701	Masthead Amp	1.25
ETI429	LM380	1.25
ETI702	Radar Alarm	1.50
ETI528	Intruder Alarm	1.50
ETI313	Car Alarm	1.20
ETI527	Dimmer	1.20
ETI116	Impedance Meter	1.45
ETI314	Auto Amp	1.00
ETI312	C.D.I	1.75
ETI430	Line Amp	1.00
ETI426	Rumble Filter	1.20
ETI428	Colour Organ	3.60
ETI533A	Digital Display	1.45
ETI533B	Digital Display	.95
ETI440	Amplifier	3.15
ETI117A	Digital Voltmeter	1.00
ETI117B	Digital Voltmeter	1.00
ETI704	Crosshatch Gen.	1.45
ETI UTILIBOARD		.85
75W3	Wiper Control	1.25
75EM6	Optomin	1.25
74 C9	Tape Deck Amp	3.25
75 SD4	FM Stereo Decoder	1.35
75 AD1	Function Generator	1.50
75 CD7	C.D.I.	1.20
ETI433A	Active Crossover	1.45
ETI433B	" "	1.45
ETI120	Logic Probe	.85
ETI121	Logic Pulser	.85
ETI118	Frequency Counter	1.20

Post and Packing 75cents for 1 to 3 boards
So buy more & save!

NEW KITS

Check these latest additions to our range of popular Kits:

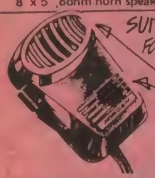
Kit No 78	FM Stereo Decoder ... E.A. April 75	$10.75
79	ET Radar Intruder Alarm. ... E.T. May 75	$54.00
80	E.A. July 75 C.D.I. ...	$22.50
81	Crosshatch/Dot Generator ... E.T. Aug 75	$21.50
82	E.A. Transistorised Ignition. Neg. earth only but easily converted to pos. earth ... E.A. Aug 75	$17.50
QC8	Kit version of fabulous Profords Digital Alarm Clock ...	$34.50
QC8	Quartz Crystal Battery Adaptor for all Fluorescent Readout Clocks ... E.A. Sept 75	$12.50

NEW PRICES

Kit No 11	PM143 ...	NOW $69.90
71	ETI422 ...	NOW $118.00

A popular old Kit revived:

1	E.A. Digital Logic Trainer MKII, ... E.A. Mar 73 Revived by demand Ideal for Schools and other Educational Institutions	$82.00



CDM1541 NOISE CANCELLING MICROPHONE
Ideal for Amateur and P.A. use, the CDM1541 features twin inserts which are out of phase to ensure good noise cancelling. Fitted with high quality PTT switch and coiled lead. Frequency response is from 300 to 5kHz, 250 to 600ohm. You could pay upto $30.00 for a unit like this. Excellent value at only **$8.90**

3 WAY CAR CONVERTER IN STOCK AGAIN
Fits any cigarette lighter and gives 6, 7½ or 9V at up to 300mA. Supplied with polarity reversing extension cable and 4 way plug-socket adaptor which fits almost everything! Converter alone is usually $5.50. Get converter and adaptor lead for only $4.90. (p&p 75c)

5" INDOOR/OUTDOOR SIREN HORN
Ideal for any location giving wide dispersion and medium power scream. Simply connect up to a 12V dc supply (via a switch!) and get a really good sound.
High impact ,plastic housing measures 5½" by 3½" deep. Supplied complete with mounting bracket. All hardware is non-corrosive or rust-proof).
Use one as a car siren, domestic alarm etc etc.
Great value at only **$22.50** (P&P $1.00)

SUPER-SENSITIVE METAL DETECTOR

Just tell a builder or handyman about this fantastic gadget – locates any metal object – wires, pipes, reinforcing steel, even nails, inside walls and plaster etc.
- Lights comes on in presence of metals
- Penetration/sensitivity control locates metal 6" away
- Supersensitive electronic circuit pinpoints even small nails
- Easy to operate from 9V transistor battery

Range depends on size of metal object. Ideal for electricians who once had to pay $30–$40 for such a unit. And only **$9.75** (P&P $1.00)
(9V battery 75c extra)

WIDE RANGE OF NEW CMOS
AT PRICES THAT GIVE OUR USUAL FANTASTIC VALUE!

TYPE	DESCRIPTION	PRICE 1–9	PRICE 10–up	PRICE 100 mix
SCL4000AE	Dual 3 Input NOR Gate Plus Inverter	45	40	35
SCL4001AE	Quad 3 Input NOR Gate	45	40	35
SCL4002AE	Dual 4 Input NOR Gate	45	40	35
SCL4006AE	18 Stage Shift Register Static	2.75	2.65	2.60
SCL4007AE	Dual Complementary Pair Plus Inverter	45	40	40
SCL4009AE	Hex Buffer/Converter Inverting	1.25	1.20	1.17
SCL4011AE	Quad 2 Input Nand Gate	45	40	35
SCL4012AE	Dual 4 Input Nand Gate	45	40	35
SCL4013AE	Dual D Type Flip Flop with Reset	1.25	1.15	1.05
SCL4014AE	8 Stage Static Shift Register	2.75	2.65	2.60
SCL4016AE	Quad Bilateral Switch	1.05	1.00	.95
SCL4017AE	Decade Counter/Divider	2.65	2.55	2.50
SCL4018AE	Presettable Divide BY "N" Counter	2.80	2.70	2.65
SCL4021AE	8 Stage Static Shift Register	2.60	2.55	2.50
SCL4022AE	Divide by 8 Counter with 8 Decoder Outputs	2.25	2.20	2.15
SCL4023AE	Triple 3 Input Nand Gate	45	40	35
SCL4025AE	Triple 3 Input NOR Gate	45	40	35
SCL4027AE	Dual J-K Type Flip Flop with Reset	1.25	1.20	1.15
SCL4028AE	BDC to Decimal Decoder	2.10	2.00	1.95
SCL4029AE	Presettable Up/Down 4 Stage Counter	2.85	2.75	2.70
SCL4030AE	Quad Exclusive or Gate	1.00	95	90
SCL4049AE	Hex Buffer/Converter Inverting	1.00	95	90
SCL4050AE	Hex Buffer/Converter non inverting	1.00	95	90
SCL4071AE	Quad 2 Input or Gate	45	40	35
SCL4081AE	Quad 2 Input and Gate	45	40	35
SCL4416AE	Double Pole Double Throw Switch	1.00	95	90
SCL4428AE	Decade Counter 7 Segment Decoder/Driver	3.40	3.30	3.25
SCL4449AE	Economy Hex Inverter	45	40	35
SCL4511AE	BCD to 7 Segment Latch/Decoder/Driver	2.65	2.55	2.50
SCL4518AE	Dual BCD Up Counter	2.50	2.40	2.35
SCL4520AE	Dual 4 Stage Binary Up Counter	2.80	2.70	2.65
SCL4528AE	Dual Retriggerable Monostable Multivibrator	1.75	1.70	1.65
SCL5411AE	Oscillator 16 Stage Divider with Buffer	3.75	3.65	3.60
MC14553	Latch BCD to 7 Segment Decoder and Driver	10.50	10.30	10.20
CA3130	Fet Input Operational Amplifier	1.85	1.80	1.75
MM5314	DIL Clock IC	5.90	5.80	$4.20

all these CMOS are packed by us in a special conducting foam to prevent damage by electrostatic charges

Mini-Catalogue

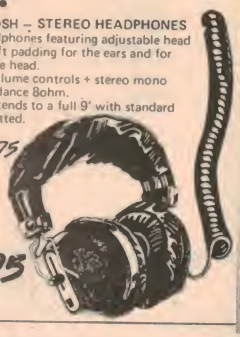
SAVE on Hi-Fi

LATEST NEWS: Extra duty on headphones, buy now & SAVE!

DEITRON DSH – STEREO HEADPHONES
De-luxe headphones featuring adjustable head band plus soft padding for the ears and for the top of the head.
Individual volume controls + stereo mono switch Impedance 8ohm.
Curl-cord extends to a full 9' with standard stereo jack fitted.

P&P $1.75

ONLY $10.95



MODEL SM220 STEREO HEADPHONES
An 8ohm headphone at a realistic price.
Cushioned pads on these phones let you drift into another world. Expanding headband suits egotists and diet watchers.
Enter the world of stereo with the SM220 Complete with lead and stereo jack.
Dick's price (before the increase in duty) is an astounding $6.95

$6.95
P&P $1.75

COLOUR YOUR WORLD WITH EXPO

Why look dull when wearing your headphones ?
The Expo CIS 50 Headphones come in two shades – a beautiful decorator Red or scintillating Yellow.
Units are 8 ohms impedance fully equipped with 6 feet of 'black' lead with a standard stereo jack for connection to your amp.

$12.99
(p&p $1.75)

SAVE $2.95

ONLY $7.50 each

CUBE SPEAKER SENSATION !
Now everyone can have Quadraphonic Sound with these fantastic little extension speakers.

Check these features:
- Scuff resistant vinyl exterior
- Modern colours
- Rugged 4" 8ohm speaker 50-20,000Hz 4watts
- Screw rear terminals
- Black fascia
- Measures a compact 128(w)x128(h) x123(d)mm

Get these handy extension speakers now for only $7.50 each. +75¢ p&p
Ideal as Transistor Radio extension speaker.

HARMON KARDON synergy one

Dick Smith has great pleasure in stocking Harmon Kardon. Cast your eyes on the system below, read the specs., then get over to Dick Smith's and seeit in the 'flesh'.

A Complete System – SYNERGY ONE (Definition: Combined Action)

The Model 330B Receiver is of the usual high quality expected from Harmon Kardon.

Brief Specs: 20/20 watts continuous both channels driven into 8 ohms.
Total Harmonic Distortion: Less than 0.5%
Intermodulated Distortion: < .5% from 1 watt to full power.
Hum and Noise: >75dB below rated O/P.
FM Sensitivity: 2.5μV (IHF)

The front of this unit shows a beaut AM/FM Scale indicated in green. The features read like film credits: Tuning meter – speaker system 1&2 – Stereo Mono switch – Tape monitor – Contour switch – the normal balance, volume, tuning, function and last but not least separate bass and treble controls for both channels.

The rear of the unit has full facilities including separate main and pre-amp for both channels – fuse protection for both channels – speakers from 4 ohms thru' to 16 ohms. And a host of other features.

The Turntable of Synergy One is the renowned CEC BD2000

This unit is a belt drive unit driven by a 4-pole synchronous motor. Place your record on the cast aluminium platter and listen to your favourite music with a S/N ratio of more than 42 dB and wow figures of less than 0.1 %.

The unit comes complete with the MG15 tone arm incorporating a universal plug in headshell. No need to buy a cartridge – that's there too! A magnetic cartridge with diamond stylus. We could tell you more – come and see us and the CEC BD2000

Finally, the end product ... the well respected HK20 Bookshelf Speakers.

These specifications speak for themselves :–
8" long throw woofer
2½" ultra wide dispersion tweeter
Response: 36 Hz to 22 KHz.
Capacity: 40 watts continuous
Design: Acoustic Suspension.

HEAR THEM TO BELIEVE THEM.

G/Tee's 2 full years on the 330B
1 full year on the turntable
1 year on speakers + 4 further years on parts.

Before telling you the price, Dick would like to quote the Harmon Kardon credo – Faithfullness in music

Faithfulness in music reproduction is note merely a compilation of impressive specifications. The final judgement comes from listener appreciation and the ability to enjoy many hours of music without strain or fatigue. COME AND JUDGE FOR YOURSELF.

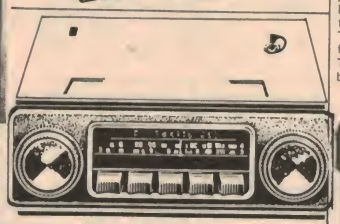
Complete System $499

A Saving of $119!

(P & P FREIGHT ON)

HEAD DEMAGNETIZER
Ever wondered why your cassette or tape recorder sounds 'hissy' even after you have attacked the heads with a cotton wool bud and cleaned them?
The answer is magnetism – most people do not realize that the so called 'magnetic head' must not have any residual magnetism on it. If it does it can adversely affect both recordings and playback.
DICK has the answer to your 'hissy' problems in the form of a very convenient 'head de-magnetiser'.
Plug this unit into the AC outlet and holding the probe about a foot away from the heads gradually bring the probe down towards the heads.
Taking the probe close to the heads, swing across them and away until you are again a foot away – this is all done with a semi-circular action.
In doing this the probe draws any magnetism from the head and leaves them ready for recording or playback.
DICK recommends you do this every five hours of recording or playback.

The cost of preserving your tapes is a ridiculously low $6.95 (p&p $1.00)



PIANOLA SR2201 – The Car Radio Bargain
Dick has been selling this little beaut for months and as we have had none back for repair, he has decided to give a real swinging price on this unit.
The radio is a push-button (5 buttons) selector or manual, the front facia plate can be altered to give black, walnut or silver satin finish. There are controls for manual selection, volume & tone and if your car is 12V positive or negative, no worries, a simple switch controls from +ve to –ve.
Pianola have everything in the one package – all hardware, supperian bibs & bobs, rear support bar, 5" speaker, support plate for the speaker and even a spare fuse. Dick makes it all complete by giving an aerial in the package deal.
This unit will fit most cars and you have no worries with a 12 month guarantee included in the price.
So what's all this cost?
DICK SAYS $49.95 . . . this saves at least $30 on comparable units (p&p $2.50)

NB: The PIANOLA SR1206 is also available at $69.95 + p&p This unit is identical to the SR2201 except it can be used on 12V + or– and 6V + or – cars. THIS IS IT YOU BEETLE OWNERS!

One of England's most popular turntables is now available at Dick Smith Electronics . . .
THE BSR 810 Automatic Transcription Turntable.
This unit has many features that will enable you to enjoy your music to the fullest extent.

The unit has a 7 lb (approx) 12" dynamically balanced diecast turntable – this takes either a single play spindle or an auto spindle (both supplied). The tone arm is of the square section type with counter-balance weight and tracking weight setting in 0.25 grams units from 0 grams to 4 grams. The arm has a slide in mount for the cartridge. The BSR 810 has an anti-skating device in the form of a knob that can be set for either spherical or elliptical styli. There is also an adjustment for set down of the styli on the record, a tone arm height adjustment (essential for different types of cartridge), a viscous daiped cueing device and an arm lock for when the unit is not being used. Five push buttons control the following functions: Manual operation, stop, 7–10 and 12 these determine set down of arm on auto operation (they relate to record size). This unit will play stacked records, one record at a time and will auto repeat single records if required. The unit has an ADC Magnetic cartridge fitted and there is a brush situated so that the stylus is automatically cleaned before playing. The speed selector is for 45 rpm and 33 rpm and has a variable pitch control used in conjunction with the supplied stroboscope disc.
This unit has other features but we lack the space .. so what's all this cost?
DICK'S PRICE $165 complete with base & cover (SAVE $26.00) (p&p freight on)

DUAL PHONE LEAD
It's late at night – you want to use your Hi-Fi and the neighbours suffer from noise phobia!
THE ANSWER IS HEADPHONES – You can listen without disturbing anyone and Dick has the answer for those people who like to share music.
Dick has a dual headphone lead.
Plug the standard stereo jack into your audio and one metre later there are two standard stereo jack sockets. Plug in two pairs of headphones and listen to your hearts' content!

The lead that can stop divorce from Dick at $3.00 (p&p 75c)

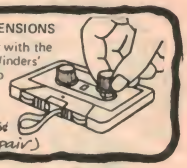
AT LAST! An AM/FM Radio at a LOW PRICE

Finished in black plastic with vinyl sides – a carrying handle complements the military design. A large indicator dial gives a semi-circular readout showing clearly FM in MHz and the AM band in Khz.
The volume control has ten position indicator for precise setting of your favourite volume level.
Band selection via a clearly indicated control under the volume control.
Telescopic aerial for FM reception and an output jack for tape recording finishes the physical description.
The SG1264A contains 9 transistors and 6 diodes and best of all sounds great. (4 penlite batteries included).

What cost a unit like this? $35 ... NO! $25 ... NO!

$19.95
(p&p $1.00)

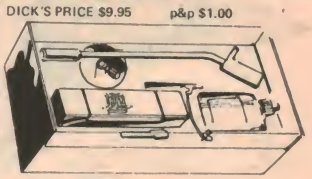
DON'T SUFFER TENSIONS
Dick has the answer with the 'Cassette Tension Winders' Use them to take up slack or for easy editing and repairs.



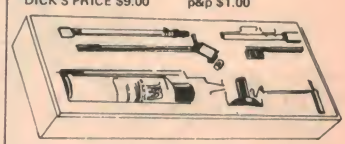
DICK'S PRICE .75¢ (per pair)

METROSOUND Audio Care Products

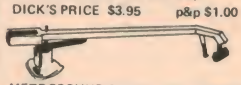
METROCARE HI FI KIT 4:
Comprising balanced arm bug + ionizer + liquid. SAVE $3.95 on this item.
DICK'S PRICE $9.95 p&p $1.00



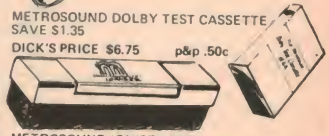
METROCARE DISCMASTER:
Dual purpose Wet & Dry cleaning arms
SAVE $2.25
DICK'S PRICE $9.00 p&p $1.00



METROSOUND JUNIOR GROOVEMASTER
Clean your records the easy way.
DICK'S PRICE $3.95 p&p $1.00



METROSOUND DOLBY TEST CASSETTE
SAVE $1.35
DICK'S PRICE $6.75 p&p .50c



METROSOUND IONISER MKII
Improved model of humid, soft velvet containing a special anti static agent.
DICK'S PRICE $2.49 p&p .50¢

DICK SMITH

CASSETTE SPECIALS!

We continue our superb Prices on cassettes

	Singles	5	10	20
BASF C60LHSM	2.50	2.00	1.85	1.55
C90LHSM	3.00	2.50	2.20	2.00
C90SMCrO2	4.25	3.75	3.50	3.25
And now HITACHI Cassettes				
C60LN	1.69	1.49	1.39	1.29
C90LN	2.25	1.99	1.84	1.69
C60UD	2.60	2.45	2.29	1.99
C90UD	2.99	2.69	2.49	2.29
For SONY enthusiasts, we have a few Sony HF Tapes left:				
C60		2.75	2.50	2.30
C90		3.70	3.40	3.10

SUPER SPECIAL

CANNOT BE REPEATED OFFER ON CrO2,C60

SPECIAL MECHANICS LIBRARY PACKS

Singles Price $1.75
10 or more $1.50

Dick has a few thousand only this item.

SAVE AT LEAST $2.40!!

p&p	1 tape	.50c	10 tapes	$1.00
	5 tapes	.75c	20 tapes	$1.75

don't forget P&P

p&p	
1 tape	50c
5	.75c
10	$1.00
20	$1.75

NEW SCOTCH CLASSIC CASSETTES

This new cassette combines the unique qualities of CrO with a layer of gamma ferric oxide. The tape is supplied in the 3M 'Positrak' backing. Bias setting needed is for normal tapes, but if you have the setting this is better. Brief specs are full 10db increased headroom at 12.5kHz before saturation. Low frequency sig/noise better than 5db above ref. High frequency is betterthan 13db. We've put it through our tests and we're really impressed. Call in and hear some!

	1 off	5	10	20 plus
C60	$3.60	$3.35	$3.00	$2.75
C90	$5.00	$4.50	$4.00	$3.50

GOLDRING ES70S MAGNETIC CARTRIDGE SCOOP!

save $4

We have this cartridge in our catalogue at $8.75, but here's your chance to buy at nearly half price! Yes we've cut the ES70S right back to only $4.75!!
Check the spec: Frequency response from 15 to 25kHz. Output is 6mV at 5cm/sec. Tracks at 1 to 2.5gm. Fitted with conical diamond stylus. 0.8milligram tip mass and high compliance.
So save $4.00 on this beaut magnetic cartridge. Now it's yours for only

$4.75

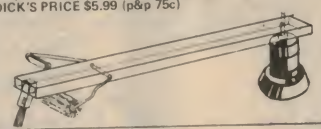
THE ORIGINAL DUST BUG!

A few years ago Cecil Watts had the brilliant idea of removing dust from records with a brush that traversed the record whilst you were playing music.

This idea is called the DUST BUG. Dick has in stock the original CECIL WATTS DUST BUG.

Housed in a see thru' plastic container the unit comprises a rubber suction pad support unit with an adjustable height rod. This is placed in a convenient place on the turntable and into it is placed a perspex arm that has a soft roller brush for picking up the dust and a nylon brush for tracking across the record. Included in the kit is a bottle of anti-static liquid and instructions.

Simple but effective — and original
DICK'S PRICE $5.99 (p&p 75c)



KB12 The adaptable rear speaker for Cars.

A 5" 5 watt 8 ohm speaker in a rear wedge mount speaker box. Undo four screws and use it as a flush rear deck speaker with a smart front grill. Finished in black high strength plastic. Wire included and packed as pairs.

Would you believe $12.00 per pair
(That's only $6.00 each!!)
(p&p $1.50)

NATIONAL RS-676 US

A front loading Cassette deck of superb specifications

Track System : 4 track 2 channel stereo
Speed : 4.8 cm/s
Wow & flutter : 0.063% (WRMS)
Frequency Response: Normal tape (MPX Filter out) 20 – 16,000 Hz
CrO_2 Tape (MPX Filter out) 20 – 18,000 Hz.
S/N Ratio: Dolby out – 52dB
Dolby in – 62dB @ 10 KHz
Harmonic Distortion: 2.0% (OVU @ 1,000 Hz)
Inputs: Mic, Line, Tuner
Output: Line, Headphones
Motor: 2 motor system
1—Electronic speed control motor for capstan drive
1—DC motor for reel table drive
Heads: HPF for rec/playback.
1 Ferrite head for erase.
Dimensions: 410mm(W)x 140mm(H)x 360mm(D)
Weight: 10.5 kg.

This unit has so many features that we can only list a few.
Operation is controlled by solenoid switches, it has memory rewind, O/P level, record level controls, selector for input source, CrO_2 – normal switching and of course Dolby switching.
With Dolby on this unit you have the opportunity of recording FM Dolby Broadcasts (experiments by 2FMBS during September in Dolby Broadcasts may become part of Australia's FM future). This enables you by taking the output from a tuner (with record out facilities) to calibrate and record the FM Dolby Broadcast direct.

Note: The purpose of Dolby Broadcasts is to remove objectionable hiss from low modulation passages, particularly classical music.

DICK'S PRICE **$525**

(p&p freight on)

NEW SWITCHES

ECONOMY TOGGLE SWITCHES

P5215 Single pole, single throw. Well designed switch with bakelite case, chrome on-off plate and handle. 1½" high x 5/8" wide x 1" deep 3/8" bushing, solder lugs. Handles 1½A at 240V

1-9 60c 10up 50c

P5216 As above but double pole, double throw. ⅝" wide.

1-9 $1.20 10up $1.00

P5217 D.P.D.T. Centre 'off' 3A rating at 240V a.c. Rugged bakelite case. Red and Black On/Off plate. Screw terminals. 1 3/8" high x ⅝" wide x 1 3/8" deep.

1-9 $1.40 10up $1.20

P5218 D.P.D.T. with enormous 6A rating at 240V a.c. Same dimensions as P5217 above. Chrome plated metal parts and screw terminals.

1-9 $2.20 10up $2.00

MS245 MS173 MS174 MS286 MS168

PROFESSIONAL "MIYAMA" SWITCHES

ULTRA-MINIATURE TOGGLE SWITCH

Almost unbelievably small size. Ideal for miniature equipment, models etc. This switch is even smaller than the normal miniature switches. 5.2mm mounting holes. 240V rating @ 1A. DPDT contacts

MS245 1-9 $1.00 10 up 80c

MINIATURE TOGGLE SWITCHES

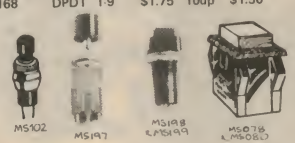
The following range of famous Miyarna switches are our most popular. They are intended for most general applications. Quality is excellent, so don't be put off by the low prices we import them direct. Rated at 240V @ 1½A. 6mm mounting hole.

MS173	SPDT	1-9	$1.10	10up $1.00
MS174	DPDT	1-9	$1.35	10up $1.25
MS286	DPDT (centre off)	1-9	$1.50	10up $1.40

HEAVY DUTY MINIATURE TOGGLE SWITCH

This switch although it is still a miniature, offers high reliability and quality. It is recommended for applications requiring the highest rating and reliability. Rated at 240V @ 6Amps!

MS168 DPDT 1-9 $1.75 10up $1.50



MS102 MS197 MS198 MS199 MS078 MS080

PUSH BUTTONS All quality Miyama brand

MS102 MINIATURE PUSHBUTTON

Push 'ON' momentary contact. 7mm mounting hole Rated at 240V @ ½A. Available in Red & Black

1-9 40c 10up 30c

MS197 ALTERNATE ACTION PUSHBUTTON

This miniature switch is of professional quality and has a full 240V rating. DPDT contacts rated at 240V @ 1½A. White button. 6mm mounting hole.

1-9 $1.80 10up $1.60

MS198 Push 'ON', Push 'OFF' PUSHBUTTON

This switch has an all plastic case and button. Rated at 240V @ 3A. Red button. 12mm mounting hole.

1-9 $1.20 10up $1.00

MS199 Push 'ON', Momentary contact, PUSHBUTTON

Identical looking to the above switch but this one features momentary 'ON'. Rated at 240V @ 3A. 12mm mounting hole.

1-9 $1.15 10up $1.00

MS078 ILLUMINATED PUSHBUTTON

This high quality illuminated switch is intended for applications where panel space is extremely limited. Supplied complete with built-in 6V globe. Rated at 240V @ 1A. Momentary contact/push 'ON'. Red button. Requires 18.5mm square hole.

1-9 $1.50 10up $1.30

MS080 ILLUMINATED PUSHBUTTON

Identical to the above but designed to give momentary contact/push 'OFF' switching. Therefore has a green button with 6V globe.

1-9 $1.60 10up $1.40

ROTARY SWITCHES

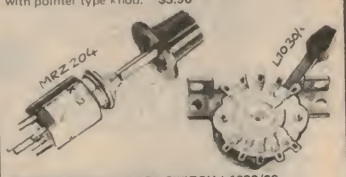
Our new range of imported rotary switches at an extremely economical price, is ideal for all projects. Spring loaded, positive detent action. 1¼" diameter with 1¼" shaft. Plated lugs. All one section. All same price

1-9 $1.45 10up $1.20

Poles	Positions
1	12
2	6
2	5
3	4
4	3
6	2

SUBMINIATURE ROTARY SWITCH MRZ204

This professional quality switch is fully dust sealed and will last a lifetime. Contacts are rated at 240V @ 1A. Switch offers 2 pole, 4 position switching. Requires 6.5mm mounting hole. Supplied complete with pointer type knob. $3.90



SUBMINIATURE LEVER SWITCH L1030/60

This is virtually a wafer type switch to which has been added a special lever action. Configuration is 2 pole, 4 way. Supplied complete with mounting bracket and neat black knob. Ideal input selector for amps etc. Mounting centres at 32.5mm. $3.75

FOOT SWITCH

Features robust crackle finish, metal case with large rubber foot pad. Lead is terminated in normal jack plug. A neat unit taking up a minimum of space yet offering a good positive action. $

SLIDE SWITCHES

Model SLS124 SUBMINIATURE DPDT

Ideal, inexpensive switch for all applications. Black plastic actuator. 18.5mm monuting centres

1-9 30c 10up 25c

MODEL SLS222 5MR

Similar to the above switch, but this one has an extremely attractive spun aluminium actuator with red insert. Ideal for poshing-up your amp front panels!

DPDT 1-9 45c 10up 40c

MODEL SLS232 7R

A subminiature 3 position, 2 pole slide switch with a spun aluminium actuator, red insert as the above switch. Mounting holes at 18.5mm centres.

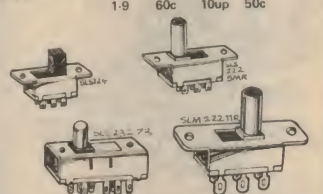
1-9 60c 10up 50c

Mounting screws for above switches 3c each.

MODEL SLM222 11R

This miniature DPDT slide switch has a beaut spun aluminium actuator with black insert in place of the usual black plastic actuator. Ideal for panel mounting where looks are important. Mounting holes at 28.5mm centres.

1-9 60c 10up 50c



ULTRASONIC WIRELESS SWITCH

Yes, here's a ready made unit for garage door opening and numerous other on-off switching applications like lights, TV etc. Operates at a distance of up to 40ft at a frequency of 38 kHz. Operating time constant is 1.2 seconds. Switching relay is rated at 600W (240V at 2.5A).
NOTE. The receiver operates as an alternate on-off device. Each signal from the transmitter changes the state of the receiver relay. However a switch on the receiver allows direct operation of the relay. Transmitter USO-12Tx operates on a 9V transistor battery. Available separately at $7.50 each.
Receiver USR-12Rx operates from 240V ac. Complete system USO-12Tx plus USR-12 Rx is yours for only $29.75 P. & P. $1.50.)

Mini-Catalogue

LATEST Amateur Gear

BOOKS

WIRE ANTENNAS FOR RADIO AMATEURS.
192 pages, 97 illustrations. $8.60 (p&p $1.00)
How to build efficient horizontal, vertical, multitap, trap and beam antennas 2–160 meters. "Invisible" antennas for difficult QTH's, 2 & 6M quickie beams· tuners, baluns, etc.

ALL ABOUT CUBICAL QUAD ANTENNAS
112 pages, 200 illustrations. $6.90 (p&p $1.00)
The world-famous "Classic" on quads! Gives new dimensions, revised gain data; Quad V Yagi; Mini Quad and Monster Quad construction; correct dimensions 6 – 80M.

BEAM ANTENNA HANDBOOK
200 pages, 122 illustrations. $8.60 (p&p $1.00)
Correct beam dimensions 6–40M. Are 40M beams worth the effort? Construction triband and compact beams; the truth about height/matching systems, baluns, and test instruments.

VHF HANDBOOK FOR RADIO AMATEURS.
336 pages, 298 illustrations, $9.95 (p&p $2.00)
Unique new handbook covers major VHF subjects in clear language : FM equipment, antennas, repeaters, VHF ants., DX propagation; satellites; EME; construction, etc.

BARLOW WADLEY

BARLOW-WADLEY XCR30 MARK II RECEIVER
(see E.A. May 73, A.R. Sept 73). This, as keen Amateurs know, is no ordinary superheat portable. It is a cunningly disguised general coverage communications receiver with a range from 500 KHz to 30MHz. There is no band switching since one dial selects MHz and the other KHz (calibrated to 10KHz). It uses the Wadley loop as used by Racal which involves a front end oscillator covering 45.5 to 75 MHz (see magazines for full description). The result is frequency scale accuracy of 5KHz reset to within 1KHz. Set the dial to WWV, switch on and you hear the signal!! Selectivity is 6 KHz A.M. 3KHz SSB. Sensitivity is limited by antenna thermal noise. Image rejection 50dB. Modes are LSB/AM/USB clarifier on SSB. Reception is of course crystal controlled. Quote from A.R.: "It would be hard to imagine a better receiver for SW listeners". A masterpiece of electronic engineering in our opinion. **$275.00 P&P $2.00**

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These units are designed to be simply connected between the aerial and receiver of any 10,6 or 2 metre unit. You can even mount them right at the aerial if you require maximum performance. Input impedance 50–75 ohm, noise factor 5·6 db gain 20 30 db, operating voltage 9–12 VDC @ 15 MA, dimensions, 70mm x 30mm x 15mm. Fully wired & tested. Circuit supplied, only 4 connectors required.

ERB–27(CB)	27–29 mHz
ERB–6	50–54 mHz
ERB–2	144–146 mHz

$18.50 ea. p&p 75c

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GM– 1 chrome plated gutter mount will take virtually any aerial – complete with mounting screws.
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CX110P 12V COAX RELAY
Don't be misled by the price. This unit has high quality gold contacts which gives an insertion loss of less than O.2 db up to 500 mHz . Very low VSWR and 1000 watt power rating. Designed to mount directly inside the smallest tranceiver.
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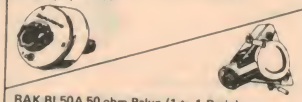

RAK BL50A 50 ohm Balun (1 to 1 Ratio)
Enormous 4 kW maximum rating, fully weatherproof, 1.8 to 30mHz band width, VSWR 1.3 : 1 high 250kg tensile strength. VHF socket supplied.
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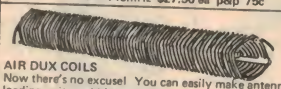
These beautiful little high performance low noise converters are supplied completely wired and tested with high stability crystal to give tuneable I.F. output on 28–30 mHz (use any communication receiver). Extremely stable and excellent specs; 50–75 ohm input Noise factor 5db, gain 30db, operating voltage 9–12 VDC @ 15 MA. Dimensions 70mm x 30mm x 15mm. Completely tested and pre-aligned. However tuned circuits may be simply re-peaked to top end of band if you wish to do so. Supplied complete with circuit.

EXC–6	50–52mHz
EXC–2	144–146mHz **$27.50 ea p&p 75c**



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No.	Diam. (mm)	Wire Diam. (mm)	Pitch per Turn	Price
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401016	40	1.0	1.6	$4.60
402042	40	2.0	4.2	$4.95
602042	60	2.0	4.2	$6.50

p&p 75c

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TANY TRS – 2 2 METRE ANTENNA – BARGAIN PRICED
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$10.50 p&p $1.00

AS–HOPE–2R MINIATURE 2 METRE HELICAL ANTENNA
This fantastic little antenna (under 9"long) screws into any VHF socket and then performs as well as a standard ¼ wave antenna. Ideal for mobile use where height is a problem and for walkie talkie operation. Made of heavy duty fibre glass with chrome on brass mounting plug.
$16.50 p&p 75c

LISTENER 3
The ultimate long range, long wire dipole antenna 3·30mHz supplied complete with Balun, feed wax (45') VHFplugs, Insulators, extremely large gauge aluminium wire and nylon support rope. Originally designed for professibnal use, but ideal for the serious short wave listener who requires the best. **$42.50 p&p $2.00**

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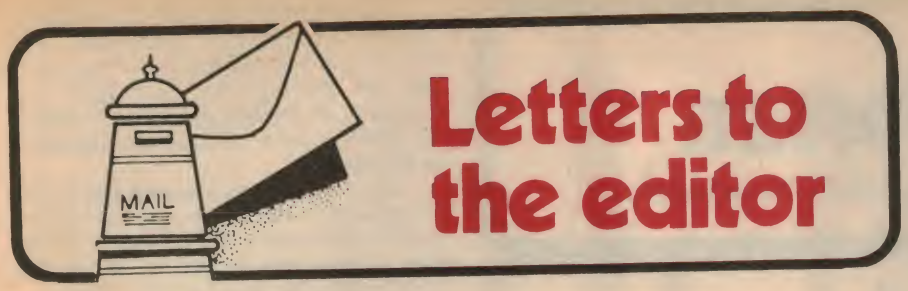


Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

Component source

There must be many of your readers—keen hobbyists like me—who are frequently very frustrated at the business of buying odd components. I have often found that the stocks held or on offer are not too comprehensive and also that the prices and delivery dates are a little daunting.

Perhaps my experience will help these unfortunates. Through my daughter in the UK, I have been put in touch with a dealer there who carries an extremely wide range of components and assemblies. The prices are much more reasonable than those applying here and the delivery is simply fantastic—I have had four orders from him in the past three months and on each occasion the goods have arrived, per air mail, within 16 days of posting the order. Even when the cost of air mail is added to the goods ordered, the prices paid are competitive in the extreme.

If any of your readers are interested, I can put them in touch with the dealer concerned – I can assure them that they will not be disappointed. Perhaps I should add that I have no direct connection with the firm concerned and I shall derive no financial benefit. But having had such good service from him, I felt that many people in Australia might like to emulate me.

Incidentally, one of the benefits derived is a system of credit vouchers. With each cash purchase, the buyer is given vouchers which, in effect, amount to 8% discount on purchases, these vouchers being redeemed on subsequent orders.

V. L. Fisher
11 Wilcox Road
Elizabeth, S.A. 5112

Circuit symbols

Members of the Institute of Draftsmen, Australia have frequently favourably acknowledged the choice of symbols used in circuit drawings published in "Electronics Australia".

Currently the Standards Association of Australia is preparing a series of standard symbols relevant to circuit drawings. Along with other relevant organisations, this Institute's representatives have played an important part in formulating definite and practical standard symbols.

Prior to the publication of these standards, symbols for new electronic components used in your magazine often proved well chosen and Draftsmen frequently adopted these as a temporary standard. As "Electronics Australia" has a wide circulation and the SAA symbols standards are now becoming available, you will no doubt adopt the standards in full.

However, may this letter be received as a mark of appreciation from Draftsmen for the policies adopted within your editorial organisation through a very difficult era in circuit drafting.

(Mrs) P. Sheridc
Federal Secretary,
The Institute of Draftsmen, Australia.

Transistor ignition

In the August edition of your magazine, there was an article featuring a transistor assisted ignition system. I've been looking for something of this nature for several months and I think it is an excellent idea. The problem is that on going to Elcoma components they presented me with a form stating that the BDY98 transistor used in your circuit was obsolete. This disappointed me, and I think that there may be quite a few of your readers who would also feel this way. Perhaps you may know of an alternate transistor for this purpose. Elcoma has a BDY96 which is the closest to the BDY98, but they do not recommend it for this purpose. Perhaps you could publish something in a forthcoming issue. I feel it would be much appreciated.

J. Wedlock.
Cooroy, Qld.

COMMENT: Your letter indicates how the situation surrounding the BDY98 has been widely misunderstood and misrepresented. When we published the article the transistor was a current type, and indeed we know of two major parts suppliers who were able to obtain stocks of BDY98. Subsequently, when Philips Elcoma re-ordered from Eindhoven, Holland they were informed that production of the BDY96/9798 series had produced very low yield of the BDY98—all the yield was going into the higher rated (and more expensive) BDY97 and BDY96. Ergo, the BDY98 is obsolete. It would seem possible that the situation might change in the future and the BDY98 might suddenly become "current" again.

The BDY97 and BDY96 may be considered to be more suitable than the BDY98 for use in our transistor-assisted ignition system by reason of their higher ratings. Unfortunately, they are very expensive. At this stage, we cannot suggest any other alternatives.

A lot to learn?

Your expert who runs the Information Centre still has a few things to learn. I am referring to his reply to N.T. of Eaglehawk, Victoria, on page 105 of the June issue.

I have received Radio Nederland (9715kHz) on my Sharp 6-transistor MW pocket receiver, which was not modified in any way. All I had to do was to place the receiver next to the mains cord of the power pack. Obviously the 5th harmonic of the set's local oscillator was responsible for this reception. It can be explained as follows: at the dial setting of 1579kHz, the oscillator frequency is 2034kHz; 455kHz above; its 5th harmonic is 10,170kHz, 455kHz above 9715kHz.

I have a QSL card from Radio Nederland, Hilversum to verify this reception.

I have thought of designing a multiband receiver which utilises the harmonics of the local oscillator instead of switching in different oscillator coils as is normally done.

Dennis Daniel, Ph.D.
Nelson, New Zealand.

COMMENT: In our reply to N.T. in the June issue we didn't suggest that it wasn't possible to receive signals by means of image reception or interaction with oscillator harmonics. We were making the point that not all ways of "fiddling" a set to produce such reception are equally desirable. In particular, we were frowning upon the idea of detuning the RF selectivity by deliberately shorting turns in the aerial coil. Nothing in your letter contradicts this point, which we still believe to be entirely valid. Incidentally if it is to work properly, a receiver along the lines you propose will probably still need a number of coils in the oscillator section—to select the appropriate oscillator harmonic for each range. Otherwise, the receiver will have a host of spurious responses.

STATION LISTS

We wish to thank those readers who wrote to register their support for continued publication of the radio and TV station lists. We hope to publish an updated list shortly.

Forum

Conducted by Neville Williams

Sidebands: as per a Fourier analyser

In the July issue, ''Forum'' dealt with one of the oldest of all arguments in the world of wireless'': the existence or otherwise of the sidebands in an AM transmission. The article has now turned up a verification for the sideband concept based on one of the newest equipments in the world of electronics!

Perhaps that last sentence in the introduction is a trifle exaggerated but what self-respecting journalist would pass up a convenient turn of phrase, simply on that account? Sufficient to say that the equipment concerned—a Fourier demonstrator, a computer and a pen recorder at Sydney's Macquarie University—add up to a very modern and useful teaching aid. They make it possible to synthesise a complex waveform from its Fourier components, displaying the result either on a CRO screen, or on paper.

In the July article we talked of the conceptual problem which enthusiasts have had over the years in respect to modulation sidebands, to the point where some have denied their existence altogether. Arguments put forward by the no-sideband school were examined, and hopefully disposed of in a deliberately non-mathematical way.

There the matter might have rested for another respectable period had it not caught the eye of a Senior Lecturer at Macquarie University, School of Mathematics and Physics. We are indebted to him for the following letter:

Dear Mr. Williams,

I refer to your Forum in the issue of July, 1975, which recently came to my attention.

Convincing students of the reality of sidebands is of course of interest in universities, and one technique used could be of interest to you and your readers.

The method is to synthesise the waveform in question electronically from its Fourier components, and display the output on an oscilloscope. Instruments to do this have been manufactured, both in universities, and now commercially. The result is a very direct and appealing demonstration of the truth of the theory.

I have also written a computer program to plot such waveforms, and these are more readily put in a form suitable for printing; four such plots are enclosed. All assume a carrier frequency of 2500 Hz and a modulation frequency of 500 Hz.

Fig. 1 shows how a carrier plus a pair of in-phase sidebands can result in normal AM. The zero crossings occur where the carrier would have them (every 200 usec.) indicating the absence of FM.

Fig. 2 shows how, if the resultant of the pair of sidebands is put at right angles to the carrier, a considerable degree of FM is obtained.

Fig. 3 shows how a further pair of sidebands can remove most of the residual AM of Fig. 2.

Fig. 4 simulates what happens to Fig. 3 if the CRO timebase is expanded, and triggered off the waveform. The FM is readily evident here.

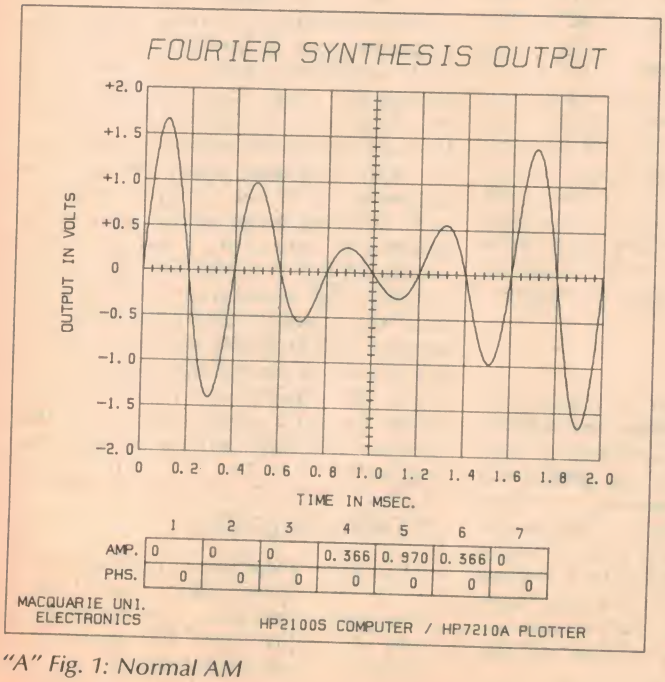
If this material is of interest, you are welcome to use the four diagrams as you wish.

Yours sincerely,
Keith S. Imrie
(Senior Lecturer)

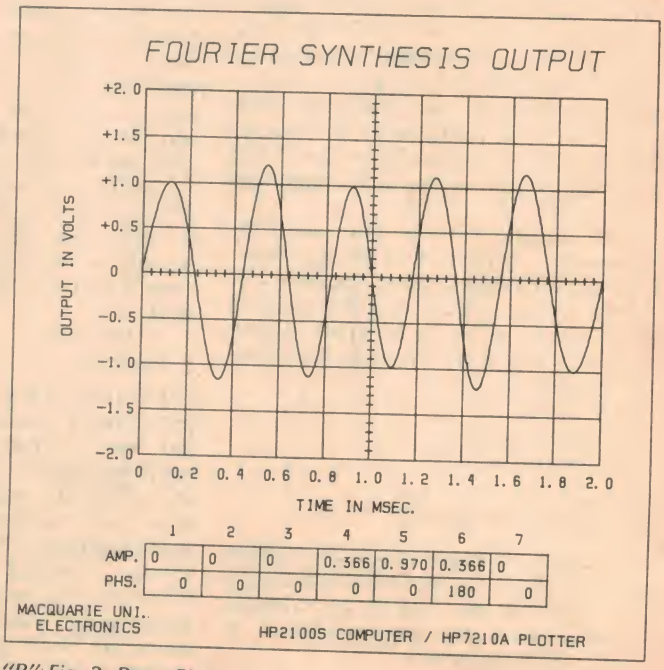
We are indeed indebted to Dr Imrie for his observations and have no doubt that many will study the diagrams with interest—not because they need to be convinced but because the equipment can display, or plot in very short order what could be done graphically—given sufficient time and patience. You may recall that we referred to the graphical approach in the July article—without attempting it!

Well, Dr Imrie's computer and plotter have done the job for us and for this we are grateful.

Changing the subject, the persistent problem of hard-to-get components has



"A" Fig. 1: Normal AM



"B" Fig. 2: Poor FM

surfaced again with a letter to hand from Dick Smith, Sydney's self-styled "electronics nut". While a published letter might seem to indicate all kinds of hard feelings, it isn't really like this. Dick Smith warned us that the letter was on the way and hinted that the matter had also been raised elsewhere.

The broad problem of electronic components is not new, of course. We devoted one whole instalment of "Forum" to it in May of last year, emphasising the difficulties that suppliers—and particularly mail order suppliers—had to cope with at the relevant time. We quoted from the English journal "Everyday Electronics" as an indication that similar difficulties were being encountered, even in a compact country like Britain.

Things haven't really changed for the better in the intervening period. There are still problems of communication and supply at all levels, the main difference being that they are now more costly! The figure of $2 which we quoted then as the bare minimum to generate a simple business letter is well and truly out of date, with rises in salaries, materials and postage.

But there's not much point in dwelling on these matters or shedding tears of lament for "the good old days". Our options are either to "drop out" or adapt and carry on, whether one's interest is electronics, or anything else one might think of.

Getting back to the present, Dick Smith's complaint is basically about the suppliers' problem when he (or they) cannot immediately meet the demand for components which are used on magazine projects. His letter reads:

The Editor, "Electronics Australia":
Dear Sir,

We have been receiving many letters from customers complaining about delay in the delivery of kits for projects which have appeared in your magazine. They blame us for the unavailability of parts, when the fault lies with our suppliers who provide the parts for the projects.

A typical example is the Radar module which we could not obtain from Philips. We feel that it is up to the magazine to ensure a good supply of special parts before any project is published. Alternatively, a second source should be located before publication.

As you can see from the enclosed typical letter, it is my company's reputation which is getting "knocked" when we are not really to blame. I would be grateful if you would comment on this in your next issue.

Finally, if you are going to continue publishing these difficult-to-get projects, we will have to stop offering kits for them. We naturally want to give our customers service and would not like to be forced into a position where we cannot do so.

(signed) R. H. Smith
(Managing Director)

Dick Smith Electronics Centre
Dear Sir,

Re Radar Intruder Alarm Kit 79, ET702.

On 26/6/75 I placed an order for the above item and paid an additional sum on 15/7/75 for a different kit which I have since received.

I am at a loss to see that a large establishment such as yours cannot honour your commitments in a reasonable time.

Even your delay notice of 3 weeks has exceeded your time limits. Please advise as soon as possible.

M.T. (Como, W.A.)

Curiously, the focus of the above complaint is not an E.A. project at all, but we take no refuge in that. Electronics Australia does not hold a monopoly on either problems or solutions. They are quite ecumenical!

Speaking for ourselves, we do regularly check out the supply position on components—despite Dick Smith's implications to the contrary. We'd be crazy not to do so.

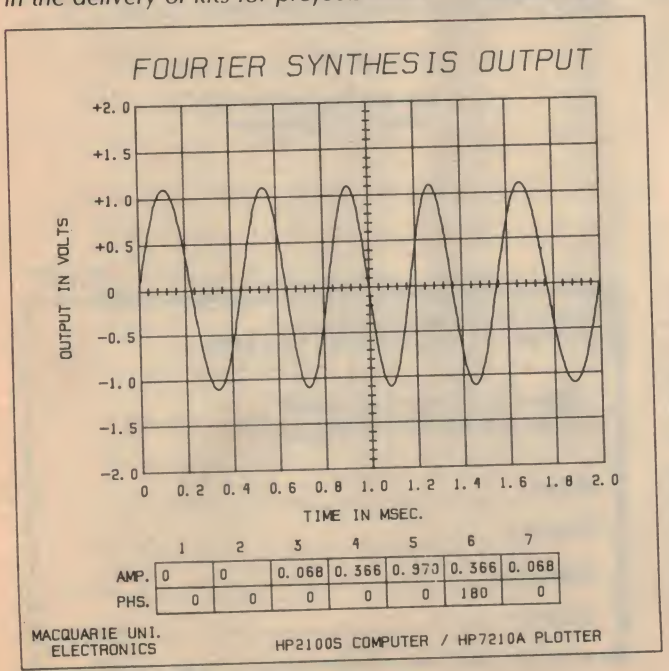
As if to emphasise the point, we currently have two completed projects "on ice" because the initial shipment of certain key components has not arrived. As soon as the essential bits show up, we'll run the articles in the fervent hope that stocks will thereafter keep pace with demand.

And herein lies a further part of the problem. One can only guess at the interest any particular project will stir up, so that suppliers and stockists alike have to "take a punt" as to how many items to order. Too many, and they're landed with dead, expensive stock; too few and they're abused for not being able to supply. Further to complicate the situation, a project may interest an equipment manufacturer and, next thing, most of the components designated for the hobby market have been bought up.

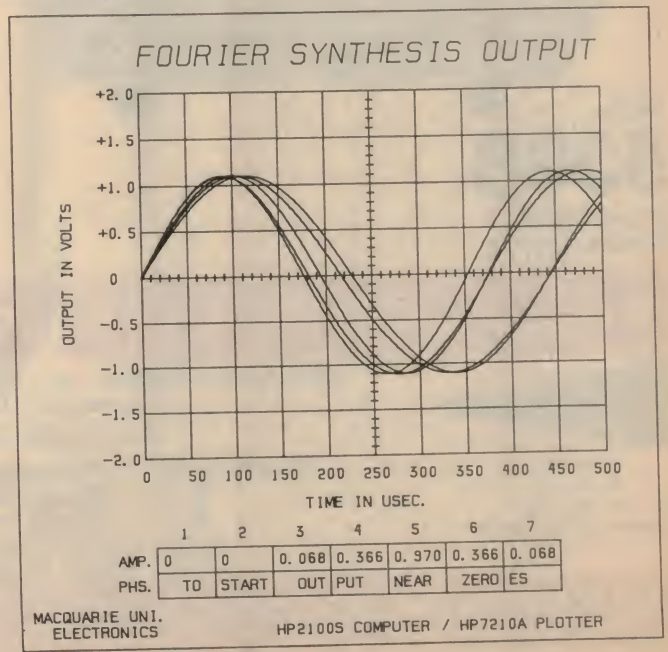
In producing the magazine, we must complete projects and designate them for publication about 6 weeks ahead of the on-sale date. At that point in time we have to make a judgement about the future supply position and hope that nothing will go off the rails while the issue is being assembled, printed and distributed.

We exercise all the care we can but, frankly, if we were to wait until all stockists had every component on their shelves, or had access to multiple supply sources, we would never describe anything but the most routine, mundane items. Then we would be roundly criticised for being stodgy, unenterprising, and behind the times!

(Continued on page 107)



"C" Fig. 3: Good FM



"D" Fig. 4: FM, expanded display.

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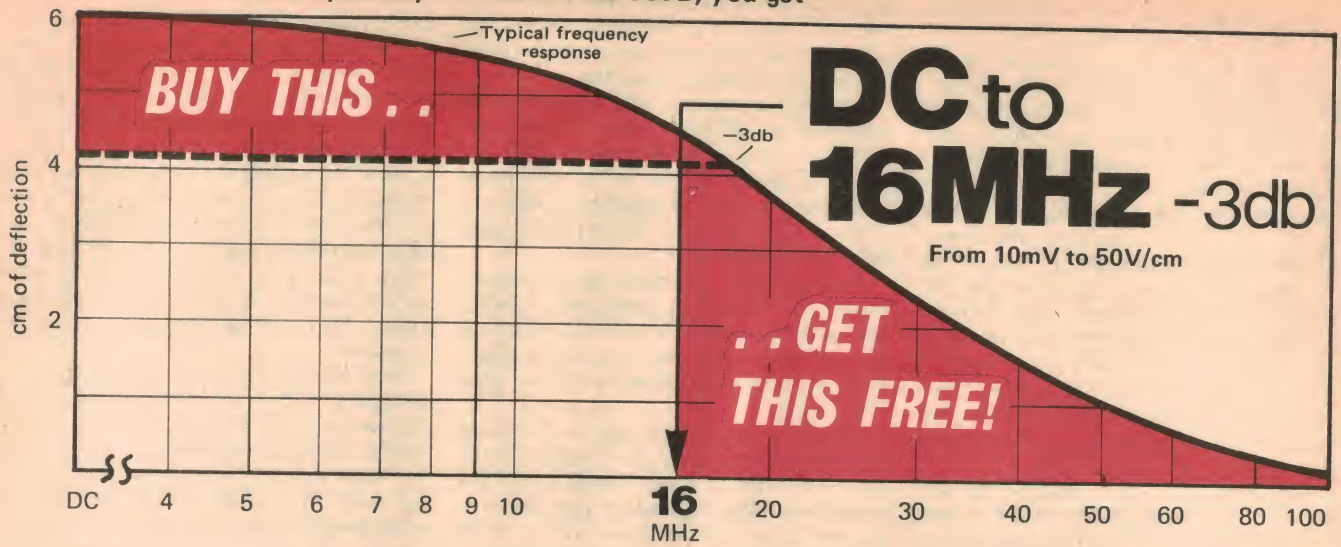

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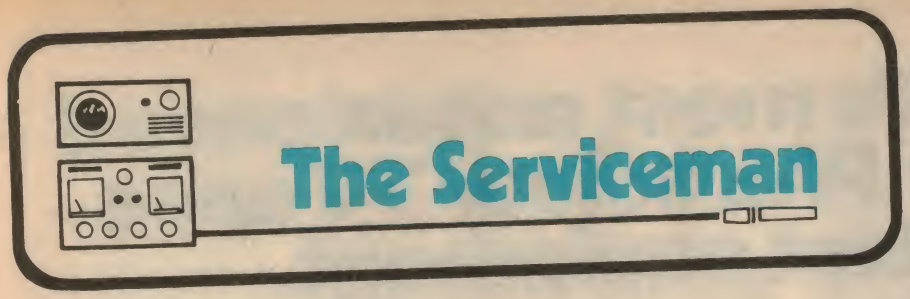

Customers—and their funny ideas

As I may have hinted before in these columns, the most difficult part of a service job is often the customer; occasionally because they are just naturally hard to get on with, but more usually because they quite innocently say and do all the wrong things. On the other hand, their quaint ideas certainly break the monotony.

Take the "dear old ladies" (D.O.L.) for instance. Whenever I get a call from a D.O.L. I reckon it's an odds-on bet that she will come up with some previously unheard-of theory or inexplicable outlook regarding modern electronic technology. The most recent call was no exception.

The complaint concerned a Philips hybrid TV set (model 12F) and was to the effect that it would receive only radio station 2JJ on all channels. For the benefit of interstate readers, 2JJ is Sydney's recently established "rock style" station on about 1500kHz, near the top end of the broadcast band.

Mind you, I couldn't blame her for complaining. It is bad enough to have a fault of any kind develop in a TV set, without having insult added to injury by it being one which brings in 2JJ. I mean, 2JJ is quite definitely an acquired taste; it certainly isn't my cup of tea and the D.O.L. could give me a few summers, so I suppose it would be even less to her taste than mine.

From a purely technical angle, I wasn't completely surprised that 2JJ was involved because she lives quite close to their transmitter. And, while I had not the faintest idea what had gone wrong, it is not unusual for solid state circuits to turn on some funny acts in the presence of RF signals. Even audio circuits are not immune, as one pop group found out recently when taxi calls found their way into a high power guitar amplifier.

When I was finally ushered into the D.O.L.'s lounge room she lost no time in demonstrating the fault. She switched on the set and up came 2JJ immediately—loud and clear. (Well, I think it was clear; it's a bit hard to tell with their programs!) Anyway, it was good room volume.

That much established I waited for a picture to appear. But after about a minute, with no sign of a picture, I tried another channel. Still no picture; just 2JJ rocking round the clock. This was a completely new development; there had been no mention of a picture failure in the message I received, nor had the D.O.L. bothered to mention it when I arrived. She seemed to be completely obsessed by the presence of 2JJ on all channels.

"See," she said, "It's everywhere. I can't get rid of it."

"But", I pointed out, "There isn't any picture."

She barely acknowledged this fact.

"Yes, but I can't get rid of this radio station, even when I change channels I still get it."

I gave up. How do you explain to a D.O.L. that, technically, the absence of the picture was a far more significant symptom than the freakish reception of a radio signal? The truth is you don't; there is just no way. All the same, I did wonder how she would have reacted had I simply fixed the sound and left the set with no picture!

Delving into the back of the set I quickly established that the basic problem was simply lack of HT supply. As I mentioned earlier, the set was a hybrid type. More precisely, it was solid state with the exception of the vertical oscillator and output stages, and the horizontal output stage. The power supply was a two section arrangement; an HT supply delivering about 250V after the filter and a 16V supply for the solid state circuitry.

I traced the HT line back to the power supply printed board and finally concluded that there was no output from the bridge rectifier—four type OA110 diodes. So I promptly replaced all four diodes; only to find that I still had no HT.

In fact, I had made the mistake of not measuring the bridge output right at the diode terminals, but rather at a nearby terminal on the board which was marginally more accessible. Now I measured it right at the diodes, established that voltage was present, then began tracing the printed pattern, with the test prod, towards my previous check point.

Suddenly the set burst into life with an ear shattering roar—the D.O.L. had turned the volume full up in her efforts to get TV sound, and left it that way. I had restored the HT with the prod by simply bridging a hairline crack in the pattern.

So that was it. A few moments' work with the soldering iron and I had bridged the break permanently and the set was back on the air—minus 2JJ.

But I was intrigued as to the cause of the hairline crack. This particular set has a 15W resistor connected after the bridge rectifier. It is quite a large device, nearly half an inch square and about one and three-quarter inches long, and is clamped hard down on the printed board. Over the years the heat from the resistor had buckled the board, eventually to the point where the copper track failed.

An inherent weakness which is worth remembering.

Equally intriguing was the reason why the set refused to receive the TV sound, since all the necessary circuitry was solid state and still operational. While I can't be sure, I imagine it was a function of the AGC system, which normally derives its controlling bias from the line output pulses. With no HT on the line output stage and no pulses, it seems likely that the bias of the tuner and video IF stages was so upset that they would not function in the normal way. And that left the way open for any strong RF signal to be rectified by the most convenient non-linearity it could find.

But I didn't try explaining that to the D.O.L.!

Another recent job was interesting in that it involved a colour TV set and a fault which I had heard about, but not seen before. The complaint amounted to lack of purity or, as the customer described it, ". . . coloured patches in the corners".

More precisely, when I saw the set the top left hand corner of the screen featured a cyan patch about 8 inches in diameter, with a similar area of green in the bottom left hand corner. It certainly produced some grotesque effects on certain types of picture.

My first impression was that either the purity had never been adjusted correctly or that someone had subsequently fiddled with the yoke position. So I loosened the yoke clamps, disconnected the blue and green guns, and tried for a normal red screen purity adjustment. It didn't take me many minutes to realise that this was not the answer; the purity adjustment just wouldn't work.

Then I did what I probably should have done first; degaussed the tube. But still no joy; the aberrations stubbornly persisted.

I was standing beside the set, wondering what to do next, and taking the weight off my feet by resting one hand on a nearby cabinet. Suddenly the penny dropped—the cabinet I was leaning on was one of a pair of speaker cabinets, the second one being in the opposite corner of the room.

But this one was only about 18 inches from the TV set. Could its magnetic field be strong enough to affect the set at this distance? I moved the cabinet about 6ft

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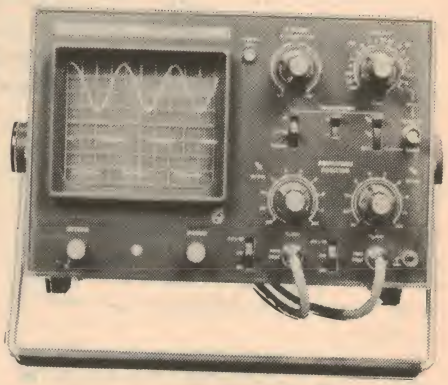

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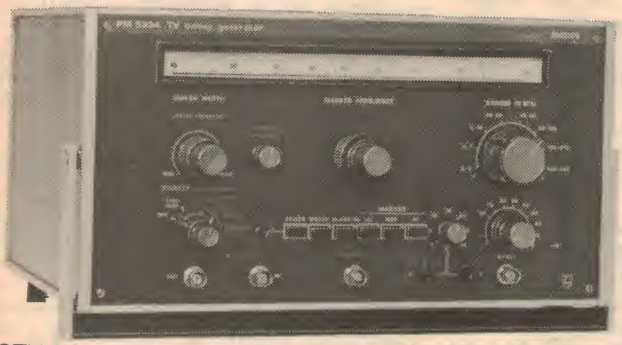

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away and went through the degaussing routine again. Result: a beautiful pure red screen from corner to corner.

Only one problem remained; to get the message across to the lady of the household, who was a foreigner with only a limited command of English. I decided that this was a case where action speaks louder than words.

Leaving the red pattern on the screen, I called her into the room. "Oh lovely", she exclaimed, and I realised that I had put that part of the message across. Then I moved the speaker cabinet back to its old position, immediately destroying the even pattern. The reaction was a little delayed this time, but she was soon nodding her head vigorously and indicating that she understood.

Then, of course, I had to move the speaker away and degauss the tube again. Still, it was worth it, particularly as I sensed that even this operation was not lost on the lady.

As I said at the beginning, this is a fault I have heard a lot about but have never actually encountered. In fact, I have heard lots of stories about the dreadful things which household appliances can do to colour TV sets, mainly from reports in the daily press.

One of the things which these garbled reports invariably fail to mention is that such appliances, to the extent that they constitute a problem at all, do so only if they happen to be switched off in the immediate vicinity of the TV set. If a vacuum cleaner was close enough to a TV set when it (the cleaner) was switched off, and if the switch happened to break the circuit at or near the peak of the AC cycle, then the collapsing magnetic field could magnetise the picture tube shadow mask and/or the shield.

These reports also fail to mention that even if this did happen, the chances are good that the TV set's own degaussing circuit would take care of the problem the next time the set was switched on. In fact, the problem I have just described may well have responded to the set's degaussing circuit, once the speaker cabinet had been removed. The reason I used my own degaussing coil was to avoid waiting 15 to 20 minutes for the set's system to cool down.

After I had written the foregoing, I had the opportunity to discuss the problem with the service engineer of one of the larger set manufacturers. It so happens that he is an inquisitive type of person who wanted to prove or disprove the theory for himself. So he placed a typical domestic vacuum cleaner under one of their models, which stands on 9in legs, and proceeded to switch it on and off.

His conclusion was that the picture tube could be magnetised on an average of about one switch-off in 25, but that the degree of disturbance was well within the capability of the set's degaussing system, when switched on from cold.

So there you have it, straight from the horse's mouth!

PICTURE TUBE QUICK-HEATING CATHODES

Recent overseas announcements have described a quick-heating type picture tube capable of producing a picture within five seconds of switching on. I was intrigued as to how this was achieved until I came across a brief but lucid article on the subject in a recent issue of "Elcoma Brief". It is reproduced below by kind permission of Philips Elcoma.

For many years the public have been accustomed to having instant sound when using transistor radio receivers, and in a similar way the transistorised sound circuits of television receivers can also provide this facility. However, since cathode ray tubes are still fitted with thermionic cathodes, it has so far not been possible to provide the "instant picture". As a general rule this means that after the set is switched on, the viewer may have to wait up to 30 seconds before the picture appears on the screen.

In an attempt to offset this disadvantage, some manufacturers have incorporated circuit designs which work on the principle that, when the receiver is switched off, the cathode ray tube heater remains in circuit, but operates at a slightly lower voltage than normal. This means that the cathode is allowed to remain hot, and when the viewer switches the receiver on again, the tube fairly quickly reaches its optimum working temperature, thus producing the effect of an instant picture.

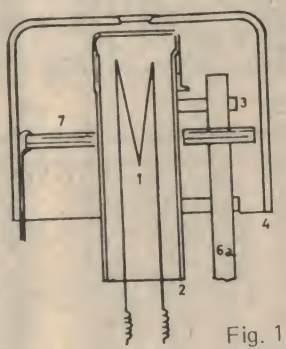

Fig. 1

Fig. 1. Conventional cathode construction as used in the Philips A66-140X picture tube.

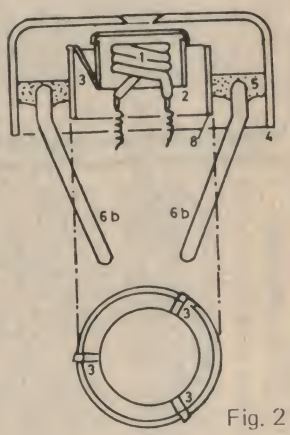

Fig. 2

Fig. 2. Quick-heating construction as used in the Philips 410X picture tube.

Key details

1. Filament/heater
2. Cathode cylinder
3. Straps
4. First grid (g^1) cylinder
5. Glass
6a. Cathode support bars
6b. Heater support bars
7. Mica insulation
8. Cathode support tube

Since it is so relatively simple to produce "instant viewing" this way, why is it that more manufacturers do not provide this facility? In certain respects this question can be answered commercially but from a technical stand-point two rather important points are raised. Firstly the television receiver must always be connected to the mains supply in order to provide the "instant on" facility, which in itself may constitute a hazard.

Secondly, the receiver is consuming power whilst switched to the stand-by position, even though the equipment is not being used.

With these problems in mind, the quick-heating cathode-ray tube has been developed using a new type of cathode construction enabling a picture to be available on the screen within 5 seconds of switching the receiver on.

The main details of this new style cathode construction can be seen in comparison with the earlier version (see Figs. 1 & 2) and are given below:

1. The use of smaller components makes it possible to heat the cathode to the required temperature more rapidly.
2. The old-style construction with a long M-shaped filament has now been replaced by a more compact bifilar-wound heating coil.
3. The inside of the cathode cylinder is given a special coating which ensures very good conduction characteristics between the coil and the cathode.

The improved efficiency in warming-up time is achieved entirely by the cathode construction, and does not involve any increase in the total power supplied to the heating coil. In fact one of the many advantages of this type of tube is that the new design has resulted in a 20% reduction in the power required. The new construction is used in 22in and 26in colour shadow-mask tubes using 110° deflection, and 12in monochrome tubes.

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The measurement of "Q" -and an economy Q-meter

Here is a novel design for an easy to build, low cost Q-meter. Fully solid state, it incorporates a low distortion RF oscillator and a measurement bridge system using two MOSFETs. The author gives full coil details to cover the frequency range from 250kHz to 23MHz.

by F. G. CANNING, FIREE (Aust)*

Some years ago an American technical magazine carried a reader's letter with which, rightly or wrongly, I profoundly disagreed. The writer of the letter was complaining that the amount of space being devoted to constructional projects was excessive. He concluded on a rather supercilious note by saying that "he supposed he would have to put up with it until the readers learned to act like engineers and buy their instruments ready-made."

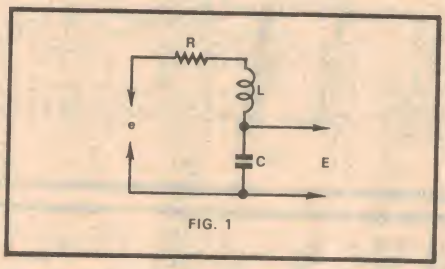

FIG. 1

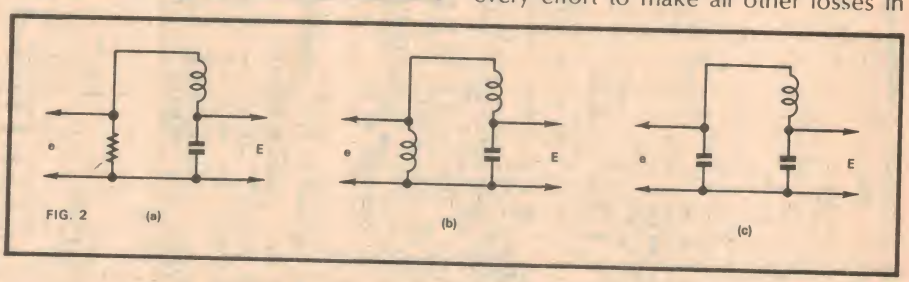

FIG. 2 (a) (b) (c)

Apart from the obvious fact that a host of small laboratories, both private and commercial, simply do not have the funds to buy numbers of expensive and highly-specialised instruments which sit idle on the bench for most of the time, it may be doubted if it is wise to breed a generation of technologists to whom the possession of manufactured and specialised "black boxes" is indispensable to their daily work, particularly if they have only a hazy acquaintance with their internals and principles. The tendency for the young graduate engineer or technician to seem rather helpless in his job unless provided with thousands of dollars worth of sophisticated instruments, like those on which he presumably was trained, was becoming noticeable in industry many years ago and the increasing complexity of electronics is probably accelerating the process.

All the same, it is true that some of the specialised instruments do save much time and effort in experimental design work and anyone who has had daily access to a good commercial Q-meter knows that it comes to seem indispensable.

This article describes a rather simple arrangement for Q measurements over a limited frequency-range, which can be made up cheaply by an experimenter and requires only the simplest calibration to give acceptable results. The circuits used are not new, but some work was done to make them practicable.

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DEFINITION OF "Q": The symbol Q, first popularised in the USA, refers to that property of a resonant circuit which has been called "circuit magnification factor" in Britain and parts of Europe. It is an indicator of the quality of a circuit or component and is defined as the ratio of reactance to resistance at the test frequency; thus $Q = X/R = 2\pi fL/R = 1/2\pi fCR$. Note especially that R is the total AC resistance of the comlete resonant circuit, not that of any individual component.

BASIC CIRCUITS: Fig. 1 shows a simple series-resonant circuit corresponding to the above equations. If we inject a small EMF, denoted by e, at a frequency f, in series with the tuned circuit, a current i of the value e/R will flow when the circuit is tuned to resonance with f. Then the EMF generated across the inductance will be (i x XL) which at resonance equals (i x XC).

We have seen that the Q, or magnification, of the complete circuit is Q = X/R or iX/iR; thus Q equals the ratio of the EMF E developed across either of the reactances, at resonance, to the injected EMF e; or Q = E/e. So if we can inject the signal e at a constant level, we can then use an RF voltmeter of negligible losses connected across either the inductor L or the capacitor C and calibrate it to read Q directly.

Remember that R in the equations is not the ohmic resistance of any part of the circuit but, rather, the total AC resistance of the complete circuit at the test frequency; therefore we are measuring the Q of the whole circuit, and not that of any component. This means that if we want to know, for example, the Q of the inductor L (in which most of the circuit losses are likely to reside) we must use every effort to make all other losses in the circuit negligible. Fortunately this can usually be done and the ratio E/e can then be taken as the true Q of the inductor or other component under test. Actually, there are several associated factors, such as the self-capacitance of inductors, which make an absolute value of Q difficult to measure directly, but they are too complex to take into account here; it is sufficient to remember that the measured value of Q will always be lower than the true value by a few per cent.

There are, however, some points which must be observed if anything like a true Q value is to be obtained. These are:

(a) The means used to inject the signal e must introduce a negligible additional loss into the circuit.

(b) The voltmeter which measures the magnified signal E must have extremely high input impedance and negligible losses, or it will load the tuned circuit and reduce the effective Q.

(c) Unless the voltmeter has an accurate square-law response (which almost none of them have, at least over the voltage range needed here) it is necessary that

the injected signal e shall have a pure sine wave-form, otherwise the voltage readings may be unreliable. This is an important point which seems seldom to be brought out.

(d) The injected signal must come only from the injection point; i.e., there must be no stray coupling or leakage of signal between the signal source or oscillator and the measuring circuit. This is not always easy to achieve.

Fig. 2 shows three possible ways of injecting the signal. All three are used in commercial instruments, the choice being dictated largely by the frequency involved. What we really want is to develop the injected Q-meter EMF across an impedance of zero magnitude in series with the tuned circuit. As this is an impossibility we have to be content to inject across a very small pure resistance or pure reactance.

Fig. 2a shows injection across a resistor, usually of around .01 to .03 ohm, small enough to be negligible with respect to the rest of the circuit resistance and specially constructed to have RF resistance virtually equal to its DC value. The method is useful for frequencies up to about 25MHz, after which it becomes increasingly inaccurate due to rising RF resistance.

Figs. 2b and 2c show injection across a small inductive reactance and a small capacitive reactance respectively. Inductive injection is often used for frequencies above, say, 20MHz because its resistance and capacitive losses can be made small enough to leave the tuned circuit almost unaffected, but for lower frequencies the reactance falls to such a low value that an impracticably powerful oscillator is needed to maintain the injected voltage at the proper value. The inductor used may be of about 0.1 millimicrohenry.

Capacitive injection (2c) calls for a large capacitor of zero inductance and very low losses; it has the opposite characteristic to 2b, working well at low to medium frequencies but failing above about 25MHz because of increasing demands on the oscillator which begins to see something like a short-circuit. The residual inductance of the capacitor also becomes troublesome.

2a and 2b are not practicable for the small laboratory because of difficulty of construction and measurement to the accuracy needed. 2c, however, is straightforward if its frequency limitation can be accepted, because the capacitive components can be bought with sufficient accuracy or built up with the help of a simple capacitance bridge. This is the method used here. It has the further advantage that small stray capacitances are less likely to affect the injected voltage.

BLOCK DIAGRAM. Fig. 3 shows the essentials of the proposed arrangement. A well-screened tunable RF oscillator with a continuously-variable output, capable of supplying 1 volt RMS to the Q-meter input at all frequencies of interest, feeds the Q-meter through a short co-axial RF cable. This standard input of 1 volt is reduced through a capacitive potentiometer to .01 volt for injection into the Q-meter circuit which is tuned by a low-loss variable air-dielectric capacitor. The magnified voltage appearing across the tuned circuit at resonance is measured on a VTVM or other RF voltmeter having scales of 0 to 1 and 0 to 5 or 10 volts. The same voltmeter, on its 1 volt range, can be switched to measure the 1 volt input to the Q-meter. Thus, with the input set to 1 volt and reduced by the capacitive potentiometer to .01 volt for injection, an output of 1 volt across the tuned circuit represents a Q of 100; likewise any observed output voltage, multiplied by 100, represents the Q of the circuit or of the coil under test in the case of an inductor. No additional meters are needed in either oscillator or Q-meter. The high-impedance voltmeter with RF probe which I described in the November 1974 issue of "Electronics Australia" is very suitable for this purpose, but any RF voltmeter with appropriate scales could be used. The Q-meter incorporates impedance-transforming buffers which make very high voltmeter input impedance unnecessary.

FUNDAMENTAL OSCILLATOR CIRCUIT.

This is a rather unusual but very useful push-pull long-tail arrangement using small-signal high gain transistors of the cheapest kind. Fig. 4 shows its essentials. The circuit first came to my notice in an interesting and valuable paper on transistor oscillators by P.J.Baxandall (1) published in 1960. A vigorous oscillator of good stability and fairly high efficiency, it can give a pure RF waveform with distortion as low as 0.1%. As can be seen, the number of parts required is minimal.

The turns ratio of the feedback winding, base to collector, is about 1:10 and not critical. Oscillation is obtainable up to about a quarter of the transition frequency ft of the transistors used, and down to very low audio frequencies. By making the emitter resistor RE variable a moderate degree of amplitude control can be had without distortion. The load resistor RL, shown dotted, is usually needed below about 5MHz in a tunable oscillator to prevent saturation of Tr2, which can produce distortion. The base battery can be 1½ or 3 volts, the collector battery of 9 to 18 volts according to output required. Note the polarity of the windings; both are in same direction and F indicates finish. The closest magnetic coupling and the least capacitive coupling between windings is, as usual, to be aimed for; windings arranged in a single layer, end-to-end and close together seem satisfactory.

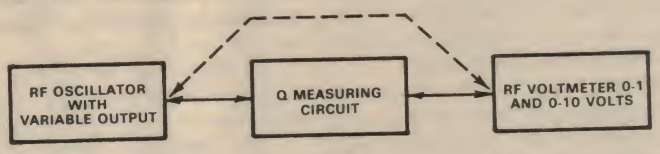


FIG. 3

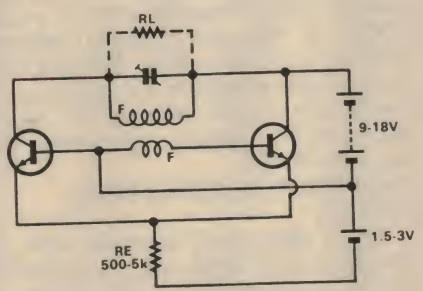


FIG. 4

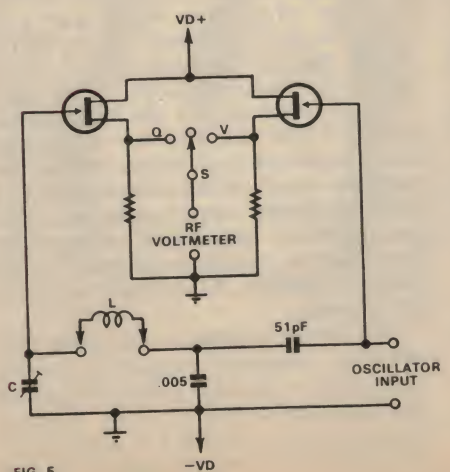


FIG. 5

Anyone who may have found transistor oscillators at all tricky might be recommended to give this circuit a trial for other purposes. A limiting resistor of about 200 ohms permanently in series with RE is a wise precaution to prevent accidental reduction of the emitter resistor to zero, with probable damage to the transistors. RL is not critical and may be around 20k ohms for a start.

FUNDAMENTAL Q = METER CIRCUIT.

This is shown, in essentials, in Fig. 5. The scheme was originally suggested by J. Luijckx(2) and his version used a twin-triode valve of RF type. In that form it works well and presents few problems, but it was felt that a semiconductor version was worth developing. It consists basically of two matched RF buffer circuits of the source-follower type, one measuring the RF input from the oscillator and the other the magnified voltage across the tuned circuit, with a switch to connect an external voltmeter to either buffer. The input of 1 volt, monitored by Tr2 and the external voltmeter with switch S set to "V", is applied to the

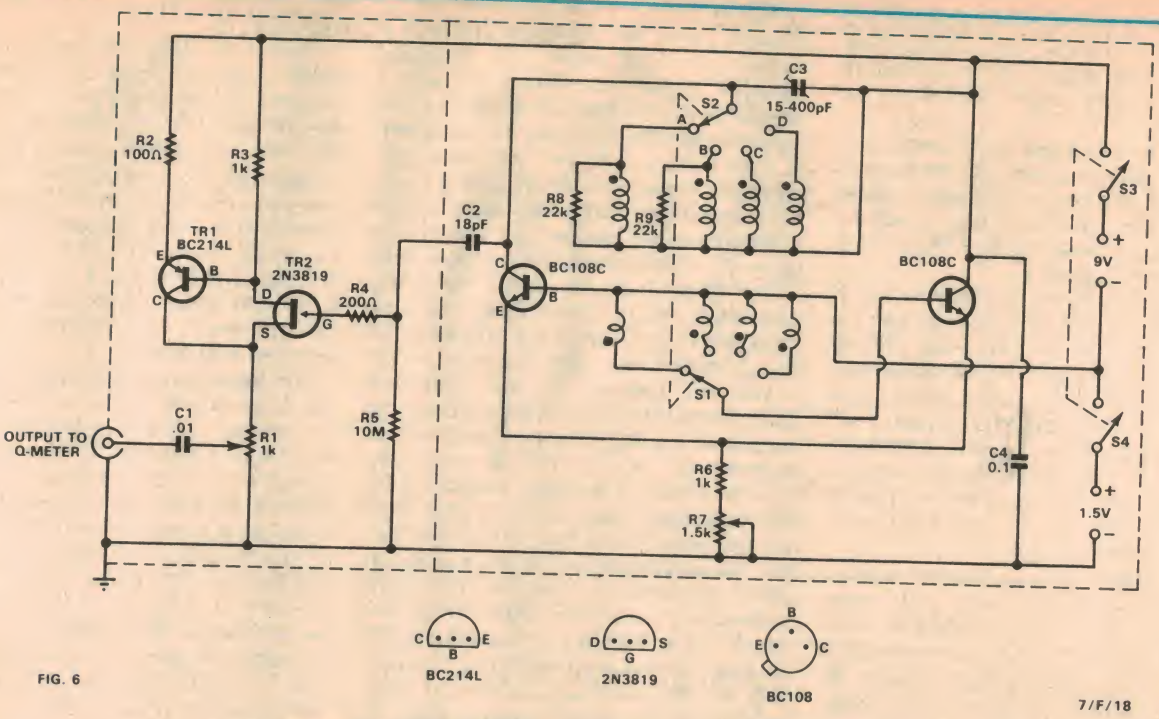


Fig. 6: practical oscillator circuit for use with the Q-meter.

capacitive potentiometer formed by the capacitors of 51pF and 5000pF. A voltage of .01 volt is thereby injected into the tuned circuit across the 5000pF capacitor which is common to both circuits.

This capacitor is too large to seriously affect the tuning and if its losses and residual inductance are minimal it will not appreciably reduce the circuit Q.

The magnified voltage corresponding to the Q appears across the tuning capacitor C and is monitored by Tr1 and the same external voltmeter with switch S set to "Q". Inductor L represents a coil whose Q is to be measured, connected to the terminals provided. A number of plug-in coils can be provided as accessories, to permit checking of other components such as fixed capacitors or RF chokes by connecting them across the complete tuned circuit.

Field-effect transistors more nearly match the very high input resistance and low losses of the original valve circuit than do bipolar transistors. They are connected as source-followers to more thoroughly isolate the voltmeter from the tuned circuit and oscillator. In the practical circuit this thought was carried further by using MOSFETS (with insulated gate) instead of the junction FETs of Fig. 5. They are fully comparable with valves in respect of high input resistance and low RF losses, and the effect of Tr1 on the Q of the tuned circuit is then negligible.

The only real difficulty about this is that the two buffers should be closely matched over the working voltage range. Twin-triode valves usually give little trouble, but MOSFETs vary much more widely and this presented a problem which has been overcome with fair success in the final circuit. From a stock of four RCA 40468 MOSFETs it was found possible to select two which tracked sufficiently well as a pair.

On paper, an attractive alternative might be the substitution of a monolithic pair of junction FETs in a single case, such as the National Semiconductor dual J-FETs 2N3955 or 2N5912, as these are especially designed for close tracking and low drift. However, there is a possibility of unwanted coupling between the two transistors since they are constructed side by side on a single chip. The capacitance between sections is not stated by the makers, and the idea has not been tested.

THE PRACTICAL OSCILLATOR CIRCUIT

Fig. 6 gives this, together with the details of coils which may be wound to cover frequencies from 250kHz to 23MHz approximately. The oscillator proper uses a pair of BC108C transistors, but other types work well with minor circuit adjustments and the BC109 should also be satisfactory. The current gain of the chosen type should be high—say 300 upwards. Tr1 and Tr2 together form a buffer stage of the compound series-feedback type which isolates the oscillator from varying loads and gives a low-impedance output at nearly unity gain without introducing distortion, provided the amplitude control R7 is not advanced unduly. R1 controls output to the Q-meter.

The whole oscillator, including batteries, is completely enclosed in a metal box, with a screening partition between oscillator and buffer as shown. All earth connections should be separately brought to the one earth point at the output co-axial socket. Note that neither side of the tuning capacitor is directly earthed. An insulating coupling between its shaft and the outside control dial or knob removes hand-capacitance detuning. The linear type output control R1 may be of either carbon or wire-wound type. The isolating capacitor C1 is not needed for use with the Q-meter, but is included to allow the oscillator to be used separately for other purposes where the output load may be conductive.

THE PRACTICAL Q-METER CIRCUIT.

Fig. 7 gives this circuit. The only critical components are the voltage-divider capacitors C6 and C7, which for accurate Q measurements should ideally be of ± 1% tolerance, or as near as can be managed. 50pF will be the nearest size commercially obtainable for C7 and should be good enough. If the "preferred value" series is obtainable, C6 and C7 can be made 47pF and 4700pF respectively. They must both be of the silvered-mica type and the wire joining them should be fairly short and of low capacitance to metalwork and other components. C6 must be joined to the "L" terminal and to the tuning capacitor C2 by the shortest possible portions of its own pigtails to keep its inductive component to a minimum. The actual layout will depend somewhat on what is used for C2, which should be of the best quality obtainable, if possible with ceramic stator insulation. A straight-line-capacitance law (i.e., with semi-circular rotor plates) is perhaps best on the whole, giving a more rational capacitance calibration.

C3, a variable air trimmer of 30 to 50pF maximum with an external dial, together with the "C" terminals or sockets, can be

ECONOMY Q-METER

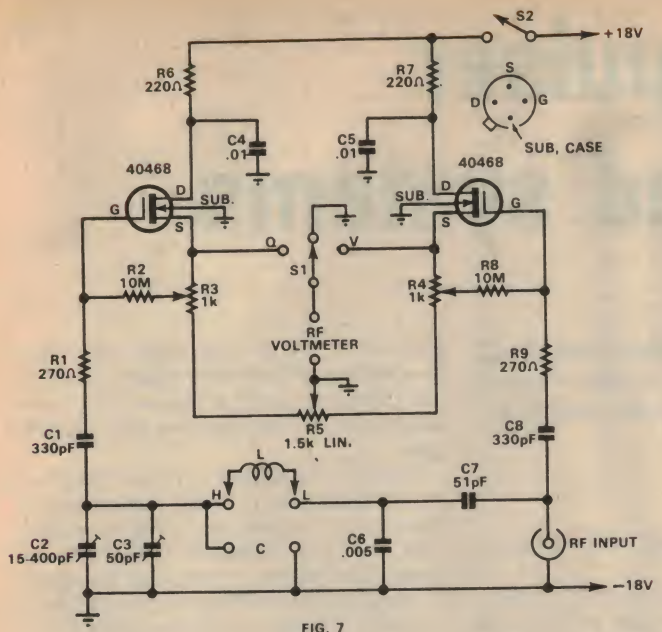


FIG. 7

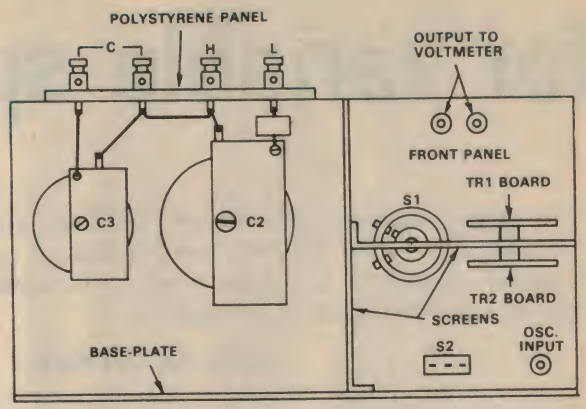


FIG. 8

Fig. 7 (at left) shows the practical Q-meter circit, while Fig. 8 (above) shows a rear view of the suggested circuit layout.

omitted if desired but is very useful for fine tuning and as a means of measuring small capacitors and the capacitance and Q of switches, sockets, RF chokes, etc. If included it should have ceramic insulation and it is normally set at half-capacitance; its dial is then calibrated in plus and minus picofarads either side of this zero point. If C2 is to be calibrated in capacitance (very desirable), C3 should be set at half-scale and its capacitance included as though part of C2. Also include C6 in such calibration.

The chosen MOSFETs have a fourth lead-out connected to the substrate and to the case, denoted by the arrow; this must be grounded. Their drains are decoupled and effectively grounded by C4 and C5 which can be ceramic types. The external voltmeter is switched between their sources by S1. Note the idle contact between the V and Q contacts; this must be grounded, again to reduce stray coupling. The source bias and load resistors R3 and R4 are linear carbon trimming potentiometers with their sliders connected through R2 and R8 to the gates; by this means the gate bias can be set to equalise the drain currents. R5 is afterwards used to equalise gain.

It is not essential to completely screen the Q-meter, though it may be helpful in locations subject to electrical interference. However, the two halves of the voltage-measuring circuit must be separately assembled, each on its own circuit-board or tag-strip, and these two assemblies must be separated from each other and from the tuning capacitors and coil terminals by grounded metal screening plates. Fig. 8 shows a rear view of a suggested layout but details and dimensions are left to the constructor according to what he has available. Note that the horizontal screen bisecting the switch S1 should be brought as close as possible to the switch, in line with the previously-mentioned idle contact which should be grounded to the screen at this point.

The two transistors, each with its associated components, can be assembled on two small panels of Veroboard or any first-grade insulating material, but it is desirable to mount C1, R1 and the gate connection of Tr1 on ceramic stand-off pillars or similar low-loss material to reduce losses. The sockets or terminals for L and C measurements ought preferably to be mounted on a panel of sheet polystyrene to keep RF losses to near zero. This material is not easy to buy in sheet form but useful pieces can often be had in hardware departments in the form of plastic boxes or containers, which are usually cheap. It can easily be distinguished from other plastics by its peculiar metallic tinkle when dropped or struck. Choose clear material in preference to coloured kinds, and be careful when soldering on or near it—it will not tolerate heat, even as low as 100°C, without softening. And never allow kerosene or any other petroleum spirit on or near it, or it will "craze" or crack. Other good materials would be polyethylene (polythene), Teflon or polycarbonate, if obtainable in sufficient thickness, but all are rather flexible and may need some support. First-grade ruby mica is also satisfactory and can sometimes be had from suppliers of insulating materials in sufficient thickness to make small panels of adequate strength. Its cut edges are best sealed against moisture with a good tropical waterproof varnish or wax before finally mounting in place.

Input to the Q-meter is by a 50 ohm or 75 ohm RF coaxial cable about 9 inches long with a suitable RF plug at each end, to match corresponding sockets on oscillator and Q-meter. Output to the voltmeter would ideally be by a similar socket and plug but this could be inconvenient, and if the previously-described voltmeter and probe is to be used, two terminals on the Q-meter will be more suitable to receive the existing crocodile clips on the probe.

SETTING UP. (1) Set R3, R4, and R5 of the Q-meter to around half their travel. Connect a multimeter, set to a low DC volts range, temporarily across the drains of Tr1 and Tr2. Connect a 10mA meter in series with the 18-volt supply. Switch on and adjust R3 and R4 until the multimeter reads zero volts (indicating equal drain currents) and the total supply current is about 3 milliamps. Switch off and disconnect the multimeter.

(2) Temporarily disconnect the tuning capacitors C2 and C3 from terminal "H" and connect this terminal to the RF input (junction of C7 and C8). Connect up the oscillator and voltmeter and switch on. Adjust the oscillator output to give a reading of about 1 volt on the voltmeter, then adjust R5 until throwing S1 from "V" to "Q" gives the same voltage reading. The two buffers are now balanced. Restore the connections to C2 and C3.

If these procedures (1) and (2) cannot be made to give equal "V" and "Q" readings, Tr1 and Tr2 differ too much in their characteristics and another pair will have to be selected. I found it helpful to make up the essentials of the two buffers, less tuning circuits, temporarily on a single panel of Veroboard provided with two transistor sockets, to permit the above balancing procedure to be proved before permanent installation in the Q-meter.

OPERATION. This is quite simple. With the voltmeter on its 1 volt scale and S1 of the Q-meter set to "V", switch on the oscillator, set its output control to give about 0.75 volt reading, and adjust the oscillator amplitude control R7 while watching the voltmeter. Note the position of R7 at which the voltage ceases to rise and then back off R7 until the voltage falls by 5 to 10%. The waveform

(Continued on page 107)

Modified wiper pulser for variable speed systems

Here is a short article following on from that in the May issue describing a windscreen wiper pulser. Contributed by a reader, it describes a modified version of our design which is suitable for cars having an existing variable speed wiper system.

by B. M. BYRNE*

In the May 1975 article of EA describing a variable delay one-shot windscreen wiper, it was noted that the circuit was unsuitable for existing variable speed wipers. It went on to say that these wipers were probably completely satisfactory anyway, but my experiences have shown this to be untrue.

I fitted a single delay, relay/capacitor unit in my previous vehicle, and was reasonably satisfied with it for eight or nine years. But two years age I changed vehicles and found that my new vehicle had variable speed wipers. These were not satisfactory in all weather situations.

In actual practice the variable speed system has really only a two speed range—about the same as any other two speed system, but with the wipers continuously variable – unnecessarily – between the two limits. The variable aspect is futile.

Happily your article provided the small amount of inpetus I needed to design a modified version which is suitable for use with a variable speed system. The design has been constructed and tested, although not yet permanently installed in the car.

The main variations from the design presented in the May issue can be seen by inspecting the circuit diagram. I have used a rotary switch instead of pushbuttons, as this involves less dashboard clutter. The number of clicks around is easy to sort out without looking away from the road. As a bonus, it is easy to incorporate extra delays, by using a six-position switch.

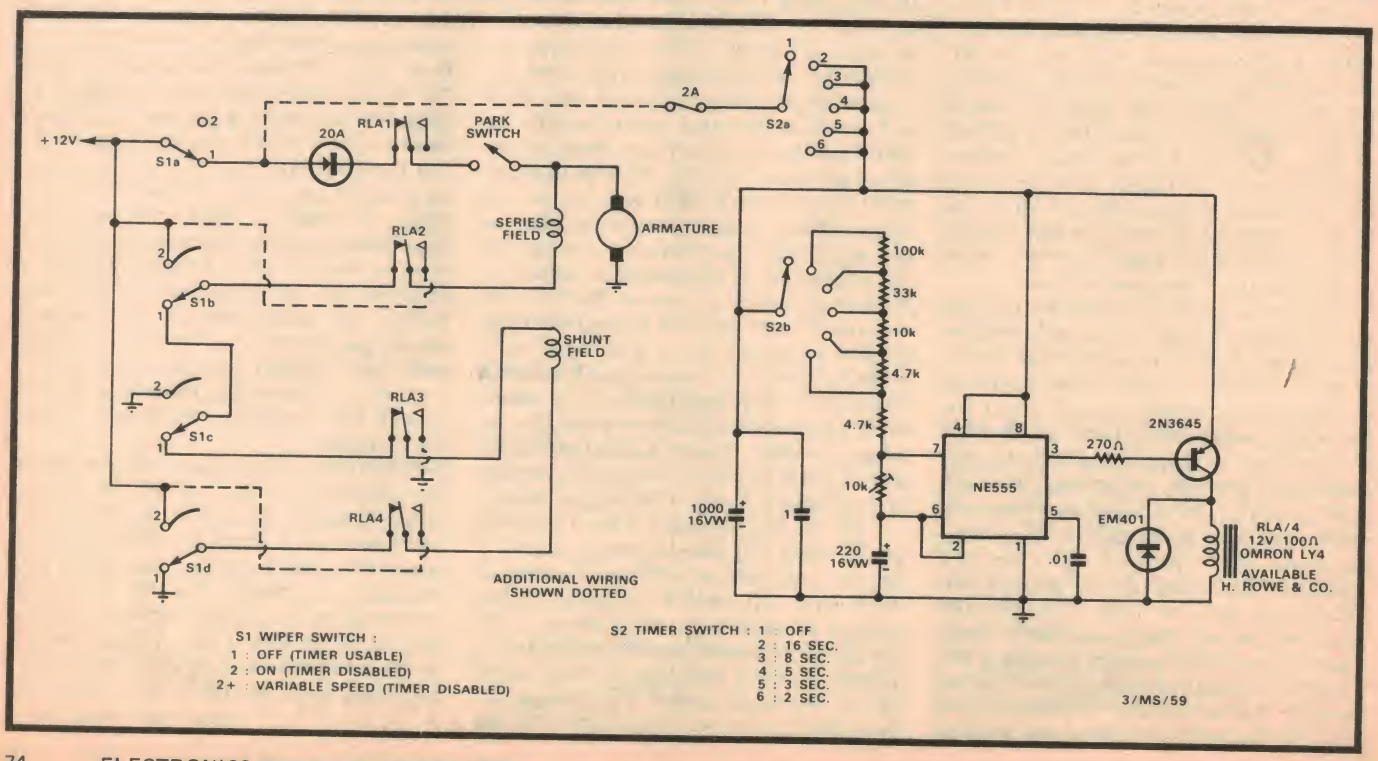
A larger relay, with four changeover springsets is necessary. The heavier load of the springsets is associated with a lower resistance coil, so it is necessary to use a discrete transistor as a power amplifier. With the type of relay specified, a 2N3645 PNP type is satisfactory, although with a lower coil resistance, it may be necessary to use a 2N4036 type.

The existing speed control system of the wiper system is rather astounding. It involves a four pole two position switch with the "on" position being rotated further to engage a rheostat for shunt field speed control. The most remarkable feature is that the motor has both series and shunt wound fields, with the park switch actuated by the motor running in the "on" position.

When the wipers are switched off, the motor fields are connected in series, and in reverse polarity. The park switch then opens when it senses the reverse rotation at the end of the wiper travel. In order to achieve the desired delay system, it is necessary to simulate the action of the control switch exactly. Hence the requirement for a four spring set relay.

By taking the power supply from the "off" position of Sla, the wiper switch overrides the timer, dropping it out in "mid-flight" if necessary. The reset time adjustment trimpot has to be set to leave the timer long enough in the "on" phase to ensure enough motor rotation to operate the park switch. At the end of

*118 Central Avenue, Indooroopilly, QLD 4068.



the delay, the wipers park by the same surprising field reversal system.

The 20A automotive diode, on a 1250 sq. mm heatsink, is to prevent inadvertent operation of the timer from the voltage drop across the motor armature when in ordinary wiper service.

While this system may not accommodate exactly every variable speed drive, I believe it can be adapted to suit most such systems. Vehicles fitted with the wound series and shunt field system as described in this article include the Rambler range—Matador, Javelin, and probably the earlier Rebel. Early Dodges are also fitted with this system, as is the Leyland P76.

The approach of this circuit system is suitable for virtually any vehicle at all, providing it has a self-park wiper system. With four changeover springsets, it is possible to "dip" into any circuit, with the "break" legs of the springset providing the override facility for normal control, and the "make" legs completing the circuit when pulsed.

The main difficulty in fitting the unit to any particular car is to sort out the wires at the rear of the wiper switch. This is best done by using the vehicle workshop manual, and observing the colour code. The actual method of construction, and the way in which the unit is installed, will depend quite heavily on the type of vehicle, and the available dashboard space, so no details have been included.

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Circuit & Design Ideas

Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

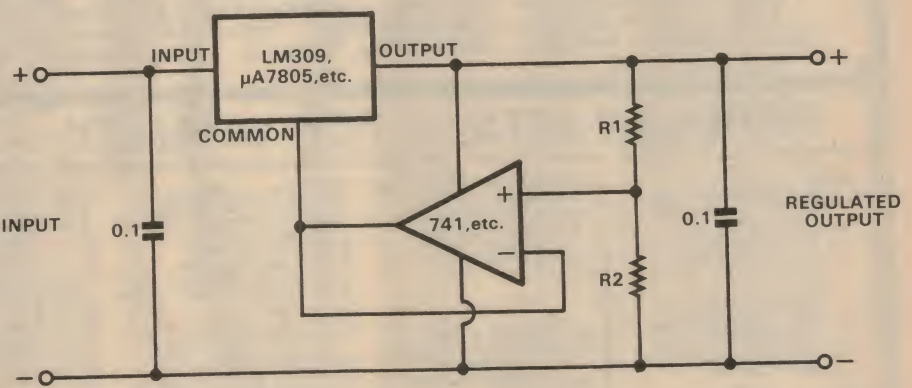
An unusual regulated power supply

Using only a 3-terminal regulator, one operational amplifier, and two resistors, this circuit can supply up to 1 amp voltages between about 7V and 33V.

The operational amplifier is used to hold the common terminal of the regulator at a fixed voltage, as determined by the ratio of the two resistors. The output voltage is then 5V more than this reference voltage. A circuit analysis shows that the output voltage is given by $5(R1 + R2)/R1$.

The maximum output voltage is determined by the maximum allowable input voltage. For the devices specified, this is 35V, so with a minimum drop across the regulator of 2V, the maximum output voltage obtainable is about 33V.

The minimum output voltage is determined by the capabilities of the op-amp. With the type specified, voltages down to about 7V can be achieved. The line and load regulation will be the same as would normally be achieved with the 3-terminal regulator alone.



If a variable supply is required, then the resistors can be replaced by a potentiometer. The 0.1uF capacitors shown across the input and output may be necessary to ensure stability.

(By David Edwards, E-A staff.)

Wow and flutter tests

Rather specialised equipment is needed to measure wow and flutter and listening tests are quite subjective, as it is not easy to distinguish between small amplitude and frequency variations. The following tests with relatively simple equipment give useful results, particularly for comparison purposes.

(a) If you have a professionally made test tape with sinewave tones, select a track of about 1kHz. Feed an output from the recorder (playback) into the vertical input of a CRO. Into the horizontal input feed an audio signal generator having good frequency stability and set the frequency to 1kHz to produce an almost stationary 1:1 Lissajous pattern, in this case varying from a diagonal line to a circle. Wow will cause the pattern to oscillate slowly through various phase angles, and flutter will produce rapid overlapping elipses. The higher the frequency of the two inputs to the CRO, the more sensitive the test will be, limited only by the stability of the audio oscillator and the quality of the test tape.

(b) If a professional test tape is not available, make a recording from the oscillator using a good quality cassette (just rewound), and proceed as before. In this case the observed wow and flutter will be the algebraic sum of the variations during record and playback, reaching twice the value obtained by method (a). If wow is due to friction in the cassette it may be partly cancelled. A square wave recording also produces an easily interpreted pattern, but use a sinewave on the horizontal input.

(c) Another version of this test is simply to view the output wave on the CRO with the normal timebase free running (without sync). Assuming the timebase frequency is stable (not necessarily the case) and having set the fine frequency control for a stationary pattern of a few waves, any frequency variations cause the pattern to drift, the direction of movement indicating the direction of frequency shift. Again, the higher the frequency used the more sensitive the test, as it is phase change we observe which is related to frequency change, not percentage frequency change as detected by the ear.

(By Mr P. H. Mathieson, M.I.E. Aust., Box 115, Kathmandu, Nepal.)

Method of measuring amplifier distortion

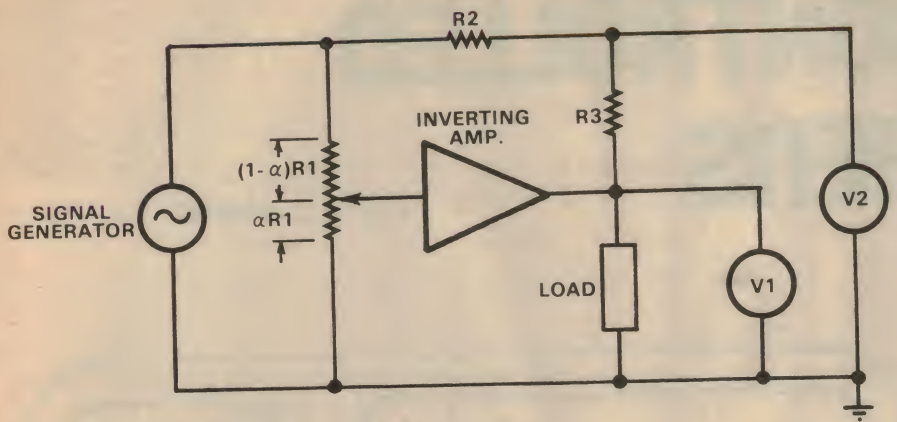
Most audio amplifiers have negligible phase shift over a reasonably wide frequency range. By using a nulling technique as described below, it is possible to make distortion measurements quite simply within this range.

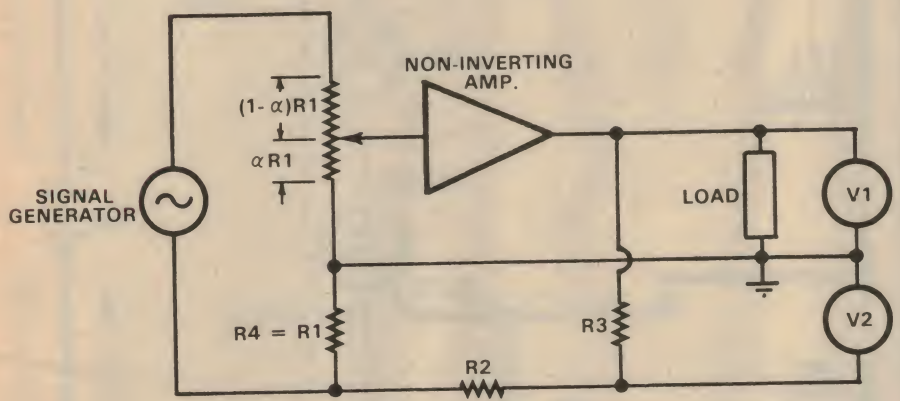
The two circuits show how the distortion of inverting and non-inverting amplifiers may be measured using only a signal generator, some resistors and an AC RMS voltmeter. For non-inverting amplifiers a signal generator with a floating output, or an isolating transformer, is required. The resistor should be selected as follows:

$R2/R3 = Vs/Vo$, with $R2 + R3 = 10k$ to 100k

where Vs = maximum signal generator output for inverting amplifier arrangement and ½ × maximum output voltage for non-inverting arrangement.

Vo = maximum desired amplifier output





voltage

$R1 \simeq 1k$

$\alpha \simeq R3/R2 \times$ amplifier voltage gain

To make a measurement, set the signal generator output to give the required amplifier output voltage (V1). Then adjust the signal generator frequency and α alternately until a minimum value of V2 is obtained. The distortion can then be calculated from:

$$\% \text{ distortion} \simeq \frac{V2}{V1} \cdot \frac{R2.Rin + R3.R2 + R3.Rin}{R2.Rin} \cdot 100$$

where, Rin = input impedance of device used to measure V2

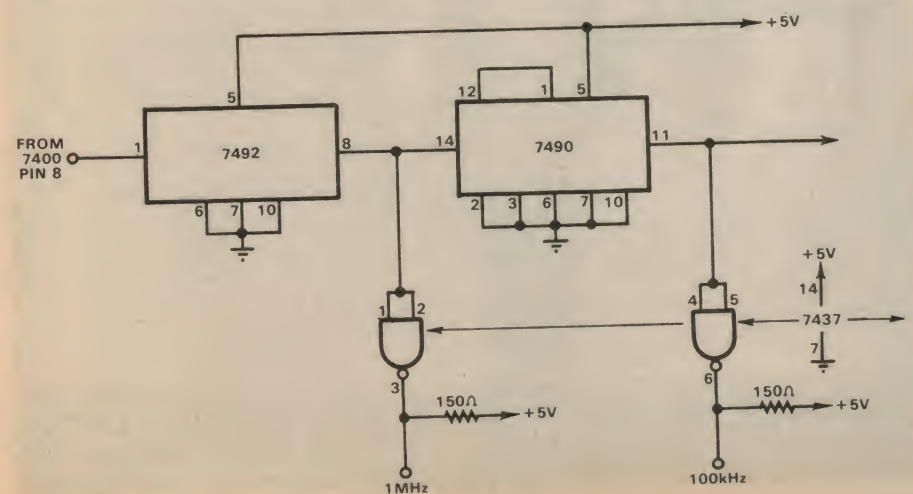
If an oscilloscope is used to measure V2, the nature of the distortion can be identified. Since a differencing technique is used, distortion levels within limits, below the distortion of the signal generator can be measured. It should be noted that this method is not suitable for amplifiers with frequency dependent gain like RIAA preamplifiers.

(By Mr N. Pollock, 126 Abbott Street, Sandringham, Vic. 3191.)

Additional dividers for VNG reference

Referring to Electronics Australia April, 1975, "Frequency Reference Derived from VNG", this additional circuit was used to adapt the output of the derived reference to provide 1MHz, 100kHz. — — —, 1Hz, as well as the 3MHz and 1.5MHz available. The 7492 divides the crystal frequency by six to provide 1MHz which is then divided by ten by a 7490 to give 100kHz. Further 7490s are used to divide down to 1Hz. All outputs are buffered by 7437 quad NAND buffers.

(By Ross Dannecker, Electrical Engineering Dept, University of Qld, St. Lucia, Qld 4067.)



SILICON CONTROLLED RECTIFIERS

by A. J. LOWE

This Teach Yourself Board introduces the thyristor or, to be more exact, one of the thyristor family known as a silicon controlled rectifier. (SCR). This board was made to show that an SCR functions as a switch which is easily turned on, but not so easily turned off.

The layout of the board is shown in the photograph. It was built on a standard wooden chassis as described in part one of this series.

The circuit diagram is shown in Fig. 1. The arrows on the lines showing current flow indicate the direction in which current is conventionally said to flow—out of the positive terminal of the battery and in at the negative terminal. The arrows are therefore pointing in the direction opposite to the direction of electron flow.

The wired model was laid out, as can be seen, with components places in the same relative positions shown in the circuit diagram.

The "switch in the gate circuit of the SCR was simply a strip of brass soldered at one end to the nail between resistors R1 and R2. It acts as a push button when pressed against the nail below its free end. The battery, comprising two AA cells, was held on the board with an aluminium clip.

The prototype used a G.E. C6A SCR which will carry 1.6 amps and block 100 volts; it is therefore overrated for its duty in this model. Almost any SCR which will carry half an amp would do instead, but the terminal pins would have to be arranged to suit. However, it is important to select an SCR which can be turned on with less than three volts. The C106Y1, available at $1, has high gate sensitivity and is a suitable alternative to the original used.

If any trouble is experienced with turning on the SCR, the value of R1 should be reduced so that the voltage applied to the gate is increased.

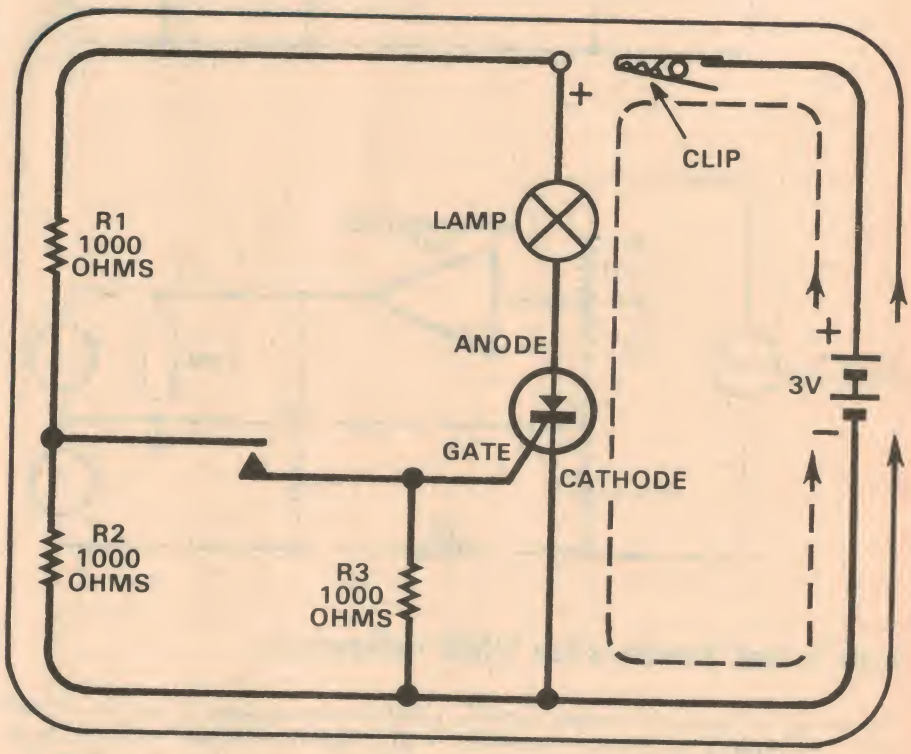
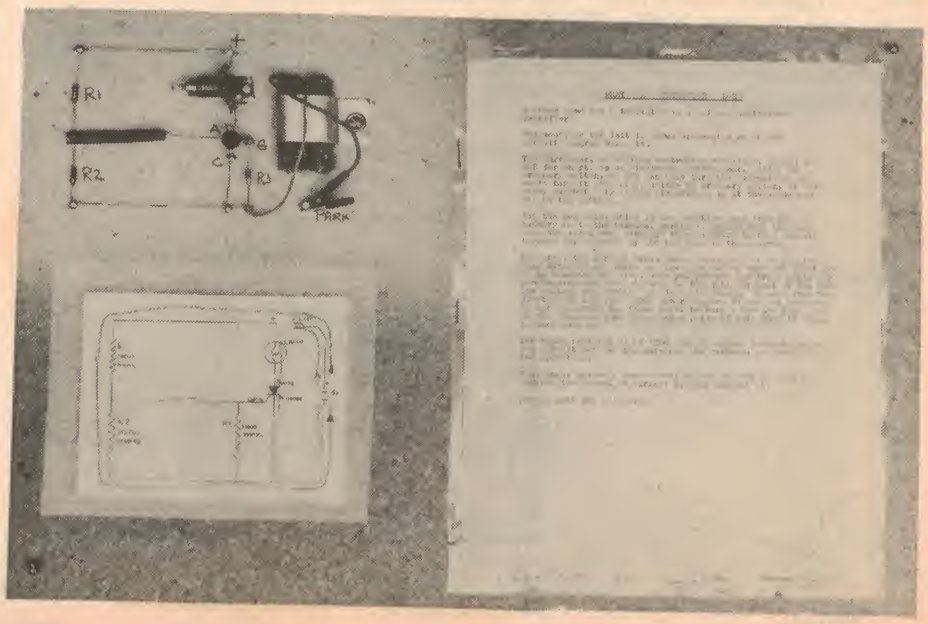


FIG. 1

PARTS LIST

3 1000 ohm resistors ¼ watt
1 torch bulb for 2 cell torch
1 silicon controlled rectifier C6A, C106Y1, or similar
2 AA cells
1 crocodile clip, brass, aluminium, nails etc



WHAT AN SCR DOES

The SCR (silicon controlled rectifier) is one of several members of the thyristor family, and probably the best known one. The (SCR) is an electronic switch. But, unlike an ordinary switch, an SCR can only turn the current ON. It can't turn it off. Also, unlike an ordinary switch, it will carry current only in one direction—in at the anode and out at the cathode.

Put the red clip, which is the positive lead from the battery, on to the terminal marked +. Notice that the lamp does NOT light even though there appears to be a circuit through it, as shown by the dashed line in the diagram.

Now press the springy brass strip down, and let it go. The lamp turns on and stays on. The only way to turn the lamp off is by removing the clip. When you pressed the brass strip you momentarily applied a voltage to the gate terminal of the SCR. The voltage was 1.5 because it came from the junction of two equal 1000 ohm resistors R1 and R2, connected in series across the three volt battery—see the solid line in the diagram. Some SCRs need a pulse of more than 1.5 volts to turn them on.

The third resistor R3 of 1000 ohms is always included in an SCR circuit between gate and cathode, to stabilise the operation.

Note that, unlike a transistor, an SCR can NOT be used to CONTROL the amount of current flowing through it—at least not in the simple DC type circuit considered here.

Please park the red clip.

FURTHER SUGGESTIONS

There are some further experiments which could be carried out by beginners who have a multimeter available.

(1) Measure the voltage between the anode and cathode of the SCR when the lamp is on. It will be about 0.8 volts.

(2) Now, unscrew the lamp from its holder (which turns the SCR off) and substitute resistors of various values (say 47 to 470 ohms) one at a time, in place of the lamp.

After each resistor has been connected, switch on the SCR using the springy brass strip, and measure the voltage between the anode and cathode of the SCR. Note that the voltage across the SCR stays fairly constant. The SCR does not follow Ohm's law.

In these experiments you have turned off the SCR by reducing the current flowing through it to zero—by removing the battery lead or by unscrewing the lamp. More precisely, the SCR is turned off by reducing the current through it until it reaches a critical value called the holding current.

You could experiment with this by substituting for the lamp a 10000 ohm potentiometer used as a variable resistor in series with a milliameter. Set the variable resistor to about 500 ohms, and turn on the SCR. Read the current flowing through it. Now increase the resistance (be careful not to decrease or the milliameter may be overloaded) and the current will drop.

At some critical value (the holding current), which may be between 0.5 and 5 milliamps, the current will suddenly drop to zero, and will not increase even though the resistance is decreased —because the SCR has been turned off.

On this board you have used what is, in effect, a push button switch to turn the SCR on. In many cases this may be inconvenient. In the next section we will look at a device which is often used to turn on an SCR, without a push button. It's called a unijunction transistor, and it can provide just the right sort of pulses needed to "trigger" or "fire" an SCR.

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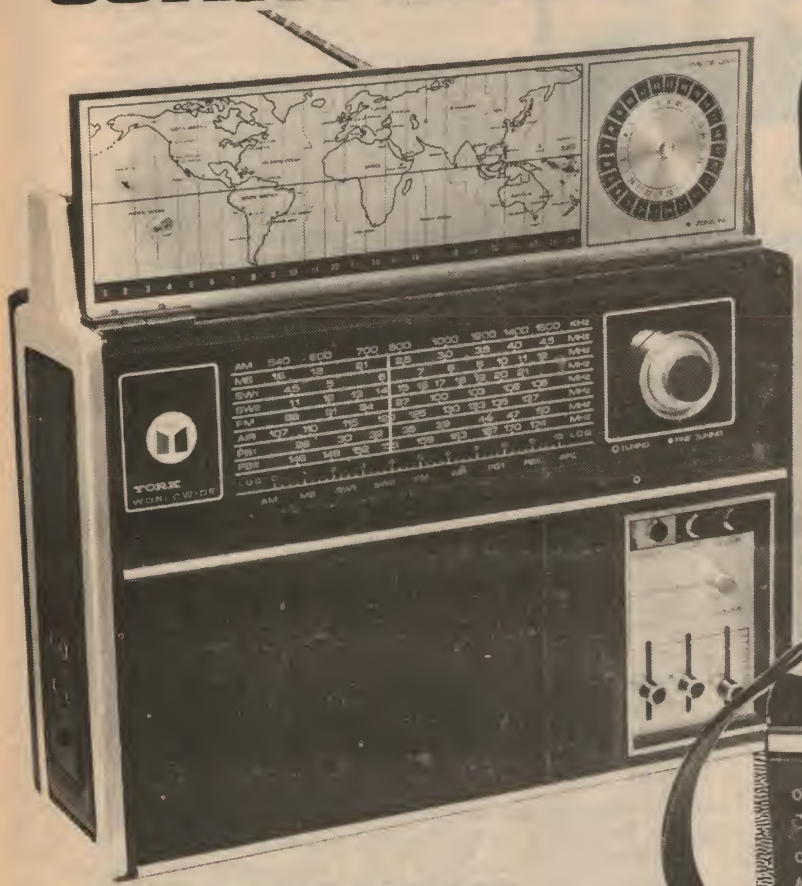

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Reviewed by Julian Russell

Orff, Carmina Burana: "disappointing"

ORFF—Carmina Burana. Cantata for voices and orchestra with Judith Blegen (soprano); Kenneth Riegek (tenor); and Peter Binder (baritone) and the Cleveland Orchestra and Chorus and Boys' Choir conducted by Michael Tilsom Thomas. CBS Stereo SBR 235726.

This work has had an unusual history. When first generally heard just after the war it made a terrific impact on European and American musical circles where it was hailed as a masterpiece. Learned critics commented sagely—and to my mind correctly—on its elemental appeal. Much was made, too, of the bawdiness of the words, especially as most were of 13th century monkish origin. In other words it was the smash hit of the immediate post-war years. Since then it has declined in popularity and some critics, after a second look at the score, have had second thoughts about its value. Personally I still find a good occasional performance of the work an exciting experience. Alas, I cannot say the same about the performance under review. Carmina's success lies in the physical impact of the forceful use of Orff's deliberately simple, steady rhythms which give the work its requisite earthy atmosphere. To alter this is to deprive it of much of its appeal. Yet, again and again Thomas does just this, going after cheap effects by increasing speed to chase mounting excitement, thereby sacrificing much of the primitive appeal.

His tempos, usually initially fast, gain wild momentum as the episode continues to scramble towards a hectic last few bars. I don't think many informed listeners would disagree with my statement that this was not Orff's intention at all. Regularity of beat with sharply accented rhythm's are essential if the work is not to acquire the alien atmosphere of the Bohemian Dance that opens the second act of Bizet's Carmen. And this distortion is all the more to be regretted because of the very high standard of the singing and playing.

Another point: The sleeve notes state, with some exhuberance, that endless care was taken to produce a quadraphonic recording with the conductor—and I presume his audience—surrounded by sound coming from all quarters. "Gift wrapped" Orff so to speak. And very gaudily wrapped, too. My pressing is in stereo and in terms of sound has its good and not so good features.

But even this aspect doesn't tempt me not to prefer many other recordings of Carmina, especially that of Fruhbeck de Burgos for HMV, though it is now just on ten years old. Perhaps the quad version might tittilate those who like listening to some of the music through the back of their necks but I cannot imagine it altering the fundamentally disappointing Thomas reading. The stereo version is spacious, if a little reverberant, with good separation but lacking in total refinement. And some of Thomas' exaggerations of tempos and dynamics become, after a while, downright annoying. The work is exciting enough as it should be played without these vulgar attempts to raise the audience's blood pressure by artificial means.

In my opinion the best feature of this issue is the picture on the sleeve of Hieronymus Bosch's Garden of Delights with its Playboy-like treatment of sex. And even this is spoiled by much of it disappearing under the poster-sized type in the title!

Simon Boccanegra

VERDI—Simon Boccanegra. Complete revised opera. Piero Cappuccilli (Simon); Ruggero Raimondi (Fiesco); Gian Piero Mastromei (Albiani); Maurizio Mazzieri (Pietro); Katia Ricciarelli (Maria); Placido Domingo (Adorno); RCA Chorus and Orchestra conducted by Gianandrea Gavazzeni. RCA Stereo ARL3 0564. (Three discs.)

When Verdi revised this opera some 25 years after its composition and added the great Council Chamber scene I wish he had, at the same time, reduced the length of the two final ones. True, anything that comes after the Council Chamber is something of an anticlimax but, even today, Simon still takes an "unconscionable time a'dying". But having said that I hasten to add that here is a very beautiful performance indeed, and it is also, for some reason or other, the first recording of the opera to be issued in stereo. And this, despite the fact that you will find many unfamiliar names in the cast. Much of the credit for this splendid set must go to the conductor, Gavazzeni, who, when sufficiently committed can still give a performance comparable only to one given by the very greatest of Italian operatic conductors, Toscanini included. And there is no doubting the extent of his commitment here.

His interpretation is excitingly dramatic to which the superb quality of the engineering contributes much. Under his direction the score is full of colour, some of it very forceful but always imbued by typical Italian delight in the sheer exuberance of sound. Yet it is never coarse and, even at its most assertive just fierce. Only one of the principals tends to disappoint—Katia Ricciarelli, who is plainly out of her depth vocally and dramatically among her colleagues. Of these, all of them fine, I choose for reasons of space, Placido Domingo, Piero Cappuccilli, and Gian Piero Mastromei for special mention.

I still have the old HMV mono set with Gobbi, Christoff and de los Angeles, the sound of which still wears very well despite its age—it was issued 17 years ago and has long since been deleted from HMV's catalogue. Its conductor, Gabriele Santini, lacks Gavazzeni's sense of urgency. And in this set, too, there was one dud in the cast—tenor Campora as Adorno. Interestingly with this set is a short note on interpretation by Gobbi in which he proclaims Simon as his favourite role. I have been very happy with this set for many years and if it were still available would, all things considered—its age, its few faults and many beauties—be in a quandary as to which to recommend. But as things are, I plump unhesitatingly for the new set. You'll have to be very hard to please if you don't agree. Simon Boccanegra is a great opera, uneven perhaps but with sublime moments, its revisions pointing the way to Verdi at his most mature and innovative. It has recently been added to the repertoire of the Australian Opera.

★ ★ ★

GRIEG—Lyric Pieces for Piano. Played by Emil Gilels. DGG Stereo 2530 476.

These little pieces, 20 in all, are not to be confused with the composer's Lyric Suite, at one time very popular as Palm Court music. You might recognise an occasional one here and there but I, personally, heard many of them for the first time on this disc, and very charming I found them. I don't seem to be alone in this experience because Gilels himself, according to the sleeve notes, didn't hear about them until late in life. The pieces were composed at various stages of Grieg's creative career, from the very beginning to almost the end. In most cases their effect relies on their simplicity and this Gilels is careful to observe. And

while some might not be in complete agreement with his treatment of a few—a very few—he offers throughout a delicious example of piano playing.

I think it was Debussy who described Grieg's music as "snow wrapped in pink paper". A pity this, if it has put you off listening to some of these enchanting miniatures. The longest of them runs only three seconds over 4½ minutes. Many are less than two minutes long—or short, whichever way you'd like to put it. Try relaxing to this discful of delicious trifles. I did so and felt all the better for it. The piano tone is impressively faithful.

★ ★ ★

SCHUBERT—String Quartet No. 14 in D Minor (Death and the Maiden). Quartettsatz (Nr. 12) in C Minor. The Melos Quartet of Stuttgart. DGG Stereo 2530 533.

This is a highly personalised reading by the Melos Quartet of Stuttgart, not to be confused with the Melos Ensemble of London. Death and the Maiden will probably be too well known to readers for me to go into raptures over the delights it offers. As to the playing, some of the accenting in the first movement is rather heavier than one expects to hear in Schubert's chamber music. By the way, the recording is so forward that I found it necessary to turn my gain way down. At normal setting there is a glare on the sound and evidence of slight tonal roughness. And even at a lower level the dynamics are very wide for this type of work.

Throughout this quartet I had an uneasy feeling that the emotion here and there sounded a little forced, as if it were applied from the outside, not growing out from within. I mean that at times there is a little more Melos than Schubert. The players, all first class technically, seem sometimes to come between the composer and his music. In the second movement, which is part of the song from which the quartet takes its name, the opening is ever so slightly too jerky for my taste. But the resulting set of variations—and how easy they are to follow!—all go along admirably taking you with them.

This is not a performance to be dismissed lightly. The vividness of its presence will make many accept the reading as well as the players' idiosyncracies. The Scherzo is fine and the steadiness of the presto Finale excellent. This steadiness makes it sound faster than it really is and also makes for splendid definition.

It is an impressive example of players displaying brilliance of technique but without bragging about their virtuosity. I think you will find the very forward sound, mentioned above, very different from the rather euphemistic tone that for some time was characteristic of DGG's sound.

I must confess to having enjoyed the fill, The Quartettsatz, better than the major work. The easy flow of tunes in this well-known piece was, to me, much more like the true Schubert. There is an altogether gentler and, in my opinion, more valid approach to the composer's style. A very beautiful performance.

★ ★ ★

SCHUBERT—Symphony No. 3 in D Major. Symphony No. 4 in C Minor. Berlin Philharmonic Orchestra conducted by Karl Bohm. DGG Stereo 2530 526.

I can guarantee that you will suffer no uneasiness about Bohm's approach to Schubert in these two early symphonies. Bohm—as always—lets the music speak for itself with the happiest of results. And if you have adjusted your gain to the quartet mentioned above you can restore it to normal for this disc. There is nothing cloying about the sweetness of Bohm's interpretation. It has of course, its more weighty moments but they, too, are always beautifully mannered. Knightly is perhaps the best way to describe these performances. The great Berlin Philharmonic is at its best, making everything sound so easy to bring off. And here there is no glare on the sound, which is right out of the top drawer. For instance, the Allegretto of the Third Symphony is really scented with its easy tempo reminiscent of a stroll through Vienna's Burggarten in Spring. I picked this movement as typical because the tyranny of space limitations prevent me from stressing individually the delights to be found in these two symphonies under Bohm's masterful direction. I can recommend the issue with the greatest enthusiasm. It might well be called attar of the younger Schubert.

★ ★ ★

TCHAIKOVSKY—Serenade for Strings. GRIEG—Holberg Suite for Strings. Netherlands Chamber Orchestra conducted by David Zinman. Philips Stereo 6580 102.

In 1965, while a guest of the Dutch Government at the Holland Music Festival, I heard David Zinman conduct the Netherlands Chamber Orchestra at the Concertgebouw in Amsterdam. His program consisted mostly of 18th century music and I was very impressed by his performance. He was then—and still is according to his photo on the record sleeve—a very personable young man obviously on the best of terms with his players. On my return to Australia I remember recommending him to the ABC for an Australian tour, though nothing came of it.

Zinman starts the first movement of the Tchaikovsky with fine attack and makes subtle changes of dynamics in the repeats of the theme. Later the faster parts of the music are all beautifully articulated and phrased. Moreover the atmosphere is always echt-Tchaikovsky. All Zinman's work displays benevolent authority. He wins a fine, full string tone and the sound is first rate throughout the disc.

The well-known waltz that makes up the second movement is beguilingly played with considerable refinement. The following Elegy, though expressive, is never sentimentalised. And the same high standard prevails in the breezy Russian Finale.

Zinman firmly refuses to miniaturise Greig's music in the Holberg Suite on the reverse side, something that happens only too frequently even when performed under some of the most famous batons nowadays. The neat Prelude is followed by an elegantly phrased Sarabande. The Gavotte is discreetly accented without plodding overemphasis. The Andante Religioso is reverent, but free from sickly piety. By that I mean it sounds closer to Bach than to Gounod. The concluding Rigadoon is as merry as all get out with the slower middle section supplying just the right contrast to the rest. This disc is strongly recommended to those with a liking for the lighter type of good music. And once again I recommend this brilliant young conductor, who shares the conducting of the Netherlands Chamber Orchestra with Simon Goldberg, to the notice of the ABC as a possibility for an Australian tour. I am sure he would be well liked.

Lighter Side

Reviews of other recordings

Devotional Records

SONGS FROM THE INNER COURT. Pat Boone, with orchestra, organ and chorus. Stereo, Lamb and Lion LL-1016 (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

A phrase borrowed from the Inner Sanctuary of the traditional Jewish Temple, the title nevertheless describes a collection of traditional hymns which speak of the most intimate relationship between an individual christian and his God. The titles, all well known, will make the intention clear:

Just As I Am—I Can Hear My Saviour Calling – Into My Heart – He's The Saviour Of My Soul – I Am Thine O Lord – Have Thine Own Way, Lord – Does Jesus Care? – My Jesus, I Love You – More Love To Thee – Jesus, Saviour Pilot Me – Sun Of My Soul – Jesus, The Very Thought Of You – Fairest, Lord Jesus – I Need Thee Every Hour – A Sacrifice Of Praise.

Just before you set off to buy your copy, I think I should sound a word of caution. The arrangements, the recitative passages and the whole presentation is designed to emphasise the emotional aspect and, while this has been the clear intention, it will also heavily restrict the numbers of those who will enjoy the "tarry meeting" atmosphere. Definitely one that should be sampled personally before buying. (W.N.W.)

★ ★ ★

THE KINGSMEN. 1686 Pounds Of Gospel. Stereo, Canaan CAS-9754-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

The featured title on track 1 "Hallelujah Square" sets a slow tempo which, if maintained, could have resulted in a rather dull record. But, fortunately, the remaining tracks on side 1 really get moving, with touches of C & W, jazz, gay 20's and some slick pickin' on amplified guitars: I'll Have A New Song—Get A Little Touch—I Can Hear Mama Singing—Who's Gonna Hold Your Hand—It's Enough To Make Me Shout.

Side 2 also starts with a slow number "He's Still Living" but the remainder are brighter although, to my ears, a bit heavy on the vocal gimmicks: Over The Next Hill We'll Be Home—Jesus I Love You—Praise The Lord I'm Going Home—Glad Homecoming—I'm Trusting In Jesus.

The Kingsmen are a very skilled vocal and instrumental group and don't worry if the titles are unfamiliar—their diction is excellent. Apart from the two slower numbers: toe-tapping Gospel with voices ranging from the deepest bass to a tenor who could be mistaken, vocally, for a member of the fair sex! (W.N.W.)

SOMETHING BEAUTIFUL. Vol. 2. The Rick Powell Singers and the songs of Bill and Gloria Gaither. Stereo, Singcord ZLP-931S. (From S. John Bacon Publishing Co, 12-13 Windsor Ave, Waverley 3149.)

Volume 1, reviewed in the September issue, impressed with its smooth, gentle sound and its successor is in much the same category. It is predominantly a vocal recording, but with bright and varied instrumental backing.

The devotional songs of Bill and Gloria Gaither may not be familiar to you but they are very easy on the ear: The Waters Are Troubled – Joy Comes In The Morning – Jesus Is Lord Of All – Thanks For The Sunshine – The Church Triumphant – There's Something About That Name – Gentle Shepherd – Plenty Of Room In The Family – I Could Never Outlove The Lord – Worthy Is The Lamb.

A smoother sound than one expects from modern groups singing recent compositions, this program by the Rick Powell Singers will appeal especially to those who have tended to favour the old-fashioned hymns. (W.N.W.)

Instrumental, Vocal and Humour.....

HEAVY ORGAN AT CARNEGIE HALL. Virgil Fox; Spectacular Live Bach Concert. Vol. 2. Stereo, RCA, ARL 1-0477.

This is the second of two albums recorded in December 1973 by Virgil Fox in the Carnegie Hall, using the Rogers Touring Organ. Performed before a predominantly youth audience, and to the accompaniment of psychedelic lighting, the occasion seemed to generate the excitement of a pop concert, except that the music was that of Bach, and the artist a classical organist. If the audience applause anticipates the final bars of each item, it is for you to decide whether the enthusiasm is offensive or exhilarating.

Virgil Fox encourages the audience involvement with a spoken introduction to each item, presenting Bach as a man of fervour, a musical giant . . . "the red-blooded Bach".

To this remark one is compelled to add: a red-blooded performance also, on a red-blooded instrument! Maybe this is the smaller brother of the big Rogers which was permanently installed shortly afterwards in Carnegie Hall, but my tip is that you'll tend to forget its electronic soul as you listen to the ultimate sound. Electronic, acoustic? Merely the means to an end!

After all that, I'd better mention the track titles: We All Believe In One God—Rejoice Beloved Christians—Prelude & Fugue in E Minor—Toccata & Fugue in D Minor—Passacaglia & Fugue in C Minor. In short, a record well worth a hearing—provided you don't mind exchanging some of the traditional formality for virtuosity and exuberance. (W.N.W.)

★ ★ ★

PETER & THE WOLF (Prokofiev); YOUNG PERSON'S GUIDE TO THE ORCHESTRA (Britten). Narrated by Will Geer. English Chamber Orchestra conducted by Johannes Somary. Stereo, Astor VSD-71189.

The number of similar albums released over the years attests the popularity of this particular coupling.

"Peter And The Wolf" is a simple tale of the countryside, which serves to highlight various instrumental sounds and to illustrate how they may be used to develop a mood or a story line.

"Young Person's Guide To The Orchestra" is more directly tuitional and is a natural follow-on to "The Wolf". It nominates and describes various families of instruments, while weaving their sound into what is virtually a continuous pattern of sound.

If not by name, you will certainly recognise Will Geer from his photograph as grandpa in the TV serial "The Waltons". To my mind, however, Grandpa is not an ideal choice in Australian ears for "The Wolf". His accent is heavy and his efforts to dramatise a tale for the young-'uns tends to dominate rather than interpret the music. His "Guide To The

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.) and David Edwards (D.W.E.).

Orchestra" is much more successful.

As for the orchestral sound itself, I have no criticism. It exposes individual instruments or groups as necessary, while always ready to assert the orchestra's full weight and authority. Individual reactions will really centre on that one aspect: narration of "The Wolf" (W.N.W.)

★ ★ ★

THE CLASSICAL GUITARS OF LOS INDIOS TABAJAROS. RCA Victor. Stereo. CPL1-0668.

Los Indios Tabajaros are a very polished pair of guitarists—there is no doubt of that. Forget the fact that they originally came from the Brazilian jungles. On this album, they perform pleasant renditions of light classical tunes and in so doing create a charming Continental atmosphere which is ideal for dining or relaxing. Recording quality is excellent and surface noise on my sample was negligible.

Eight tracks are featured: Valse in A Minor, Op. 34, No. 2 (Chopin) – Fur Elise (Bagatelle in A Minor) (Beethoven) – Recuerdos de la Alhambra (Tarrega) – Hora Staccato (Dinicu-Heifetz) – Valse in A Flat, Op. 69, No. 2 (Chopin) – La Ronde des Lutins (Antonio Bazzini) – Serenata Espanola (Joachim Malats) – Romance de Amor (Vincente Gomez). (L.D.S.)

★ ★ ★

GOOD MUSIC CLASSICAL HITS. Festival Strings. Festival Stereo L 25206.

I must admit to being dubious about this album from the moment I saw it. You might call it instant disenchantment. The cover portrays three likely lasses in white strapless evening gowns standing in a park setting. Two of them hold a violin each while the third wields the double bass. From their vacuous expressions I suspect they would not know which end to play. To give credit though, they did not wield their instruments like cudgels as did one of the crooks in that famous film, "The Ladykillers".

Once I had listened to a few tracks my fears were largely dissipated. Sure, the arrangements are a little schmaltzy and there is a female chorus lah-lahing and doo-dooing from time to time but if you like light classics presented in this way, then this locally produced album is a good buy. Recording quality is very good and surface noise on my sample was negligible.

Track titles are: Moonlight Sonata –Hungarian Dance No. 5–Nocturne In E-Flat–Pathetique Sonata–Rondo Alla Turca–Claire De Lune–Waltz Of The Flowers–Air On A G String–Ave Maria–Sleeping Beauty Waltz–Fur Elise. (L.D.S.)

★ ★ ★

ROLLERBALL. Soundtrack Recording, with The London Symphony Orchestra conducted by Andre Previn. United Artists L-35597. Festival Release.

This record was quite a pleasant surprise, considering that the movie is built around a particularly violent version of the roller game set some time in the next century. With the exception of the third track on each side, an exercise in synthesiser gymnastics, the best definition of the disc would be a high quality sampler of music from Bach, Shostakovich, Albinoni and Tchaikovsky, played by one of the world's finest orchestras. The classical tracks are: Toccata In D-Minor (Bach)–Symphony No. 8 (Shostakovich)–Symphony No. 5 (Shostakovich)–Adagio (Albinoni)–and another excerpt from Shostakovich, No. 5. The quality and effective use of stereo is excellent. (N.J.M.)

★ ★ ★

WALTER DE LOS RIOS, OVERTURES. Hispavox L-35486. Festival Release.

Walter De Los Rios is up to his usual tricks in this collection of well known overtures from opera. Each track starts off 'straight' but, after a few bars, a very forward percussion group comes in and everything swings in a way that many obviously enjoy. The overtures given the treatment are: Rosamunde – Romeo and Juliet – Light Cavalry – Die Fledermaus – A Midsummer Night's Dream – Barber Of Seville – Egmont – Don Pasquale.

Like other Hispavox records I have heard, the sound quality is superb, with excellent reproduction of percussion. I would like to hear their version of 'Golden Wedding'. (N.J.M.)

★ ★ ★

VIVA MEXICO, Los Mochecumbas. Europa E1040. Astor Release.

It seems a long time since I heard much of 'South of the Border' music and this enjoyable disc certainly brings to mind the popularity of this style of rhythm some years ago. Some of the titles are standards, such as: La Bamba–La Paloma –La Golondrina–La Cucaracha and Cielito Lindo. Other tracks are somewhat more recent: Adelita–Titicaca Lake–Conao Antigo – Tony's Bolero – Guantanamera–Lupita–Coniuo Nuevo–Little Flower–Indios Noches.

The quality is really good and, if your popular music taste is becoming a little jaded, try a little touch of Mexico; I think you'll be pleased. (N.J.M.)

★ ★ ★

CHARLIE McCOY. Charlie My Boy. Monument L-35550. Festival Release.

This is another rollicking fun record from the Nashville Studios of Monument, with Charlie McCoy on Harmonica and vocal and the longest list of supporting musicians and others I've ever seen on a record sleeve.

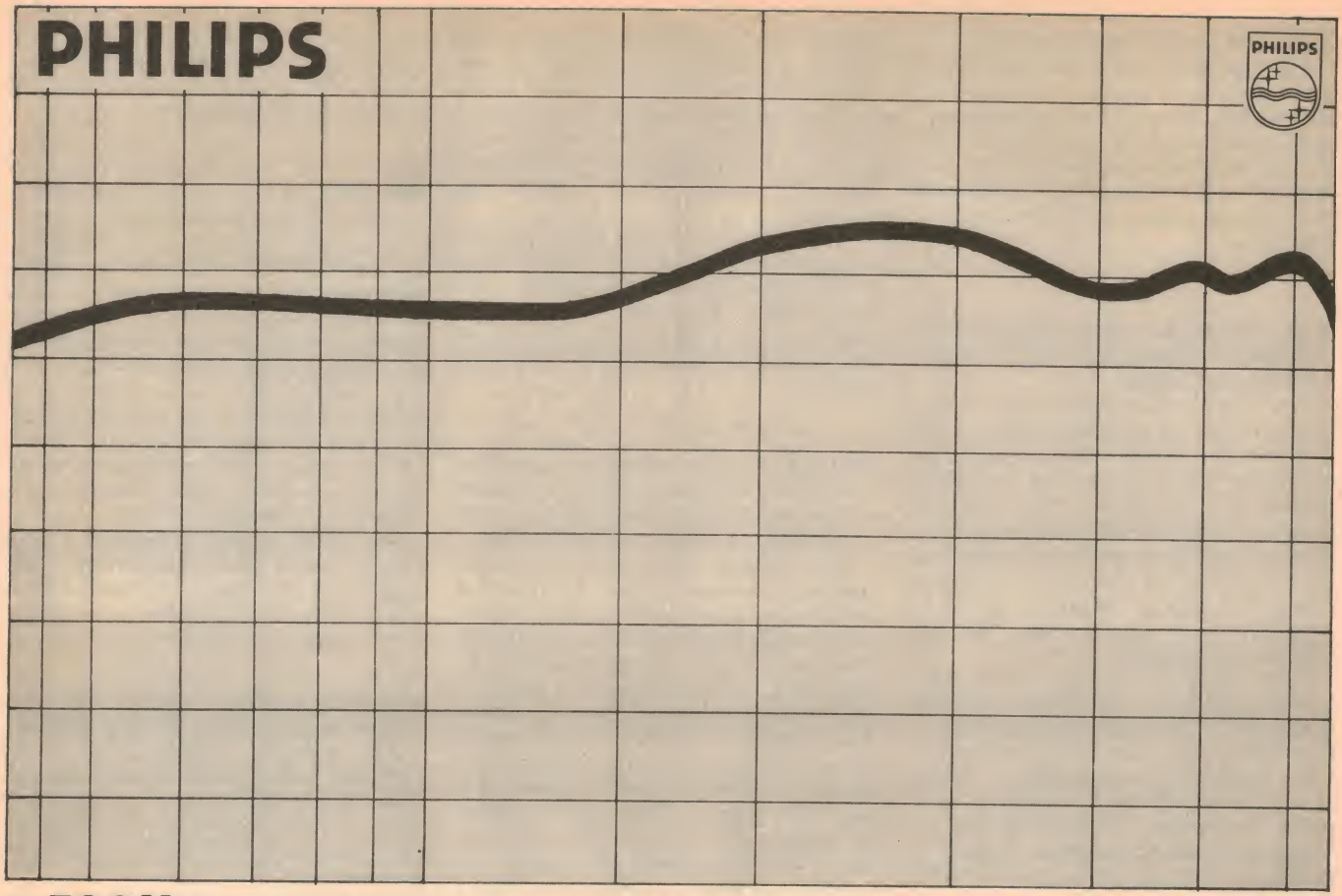
The titles are: Old Joe Clark – The Twelfth Of Never – City Lights – I Honestly Love You – New River Gorge – Please Don't Tell Me How The Story Ends – Everybody Stand Up And Holler For The Union – Making Believe – Back Home In Indiana – Sweet Memories – Juke.

The quality is the usual high Nashville standard and this would make a great party record. (N.J.M.)

★ ★ ★

KING CRIMSON USA. Island Records L 35520. Festival Release.

This is the final King Crimson album. It was recorded live in June 1974, just before the group was disbanded, at the end of a massively successful American tour. The six tracks are: Larks' Tongues In Aspic, Part II–Lament–Exiles–Asbury



500–5,000Hz and it's almost flat. How's that for about $50 worth!

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LIGHTER SIDE

Park—Easy Money—21st Century Schizoid Man.

It goes almost without saying that this record should be played loudly. I found the first track to be particularly impressive, with its muscular syncopated theme that rises through a series of crescendos to an excrutiating climax. The final track is from the first-ever King Crimson album, possibly their best known work.

Record quality is excellent, although some tape hiss is evident between tracks. (D.W.E.)

★ ★ ★

ACKER BILK, HIS CLARINET AND STRINGS. Astor Quad 1030.

No-one can dispute that Acker Bilk can play the clarinet—he can almost make it talk. But he cannot sing (as he tries on one track) and he is definitely better off without string accompaniment. So give us more of Acker Bilk and less of that other nonsense. For those to whom Clarinet and Strings appeal, the recording quality is good.

Track titles are: If I Had A Ribbon Bow—She—That's My Desire—Theme From Swan Lake—Yesterday's Smile—Love—Someone Who Cares—Bachianas Brasileiras No. 5 Aire—At Twenty One—Summer Flower—The Promise Of Your Eyes—Someone To Watch Over Me—Wandering—Auf Wiedersehen, My Dear. (L.D.S.)

★ ★ ★

STEPPIN' OUT WITH LENNY DEE. MCA Stereo MAPS 7639.

Lenny Dee has probably done more to popularise the Hammond Organ than any other exponent and he has certainly been at it for some time now. But he shows no sign of losing the ability to put out lively versions of popular songs. Recording quality on this album is fine and the stereo spread is of the three-channel variety. A good buy.

Eleven tracks are featured: Steppin' Out (Gonna Boogie Tonight)—Bonaparte's Retreat—Room Full Of Roses—If You Love Me (Let Me Know)—You're Having My Baby—Rock Your Baby—Feel Like Making Love—Annie's Song—The Entertainer—I Honestly Love You—I'm Leaving It All Up To You. (L.D.S.)

★ ★ ★

IF I ONLY HAD TIME. John Rowles. MCA Coral stereo COPS 7546.

I could adopt this album as my own theme song but that is not the only reason for approving this disc. The big-voiced New Zealander is a fine performer who puts a great deal of zest and feeling into every song. And this disc is a bonus with sixteen tracks and all of them good numbers. Quality is good. A very good buy.

The sixteen tracks are: If I Only Had Time—I Must Have Been Out Of My Mind—Another Tear Falls—One Room World—Aquarius/Let The Sunshine In—Save The Last Dance For Me—Hush . . . Not A Word To Mary—One Day—All Kinds Of People—A Lifetime Of Love—You've Lost That Lovin' Feelin'—What Are You Doing TheRestOfYourLife—WhatGreaterLove—Where Do I Begin (Love Story)/The Windmills Of Your Mind—In The Name Of Heaven—The Way Of Love. (L.D.S.).

★ ★ ★

THE MOOD I'M IN. ABC Records. L35571 Festival Release.

Diana Trask left these shores some time ago to make her name in the USA and, judging by her performance on this disc, she has certainly done this. A number of the tracks are getting a lot of play at the moment, particlularly 'Oh Boy' and 'Country Bumpkin'. Other tracks are: A Whole Of Things To Sing About—Fever—Back Home Again—There Has To Be A Loser—I Can Take A Little Heartache—Sunshine—Evil On Your Mind—Alone Again Naturally—I've Been So Wrong For So Long.

There is a sad country theme running through most of the songs but the overall quality is excellent. (N.J.M.)

★ ★ ★

DON WILLIAMS. YOU'RE MY BEST FRIEND. ABC Records. L-35556. Festival Release.

If you like a pleasant deep voice in a series of country flavoured songs, give this record a hearing. The tracks are: You're My Best Friend—Help Yourselves To Each Other—I Don't Wanna Let Go—Sweet Fever—Someone Like you—Love Me Tonight—Where Are You—Tempted—You're The Only One—Reason To Be. The list of backing musicians reveals a number of names that crop on nearly any record that comes from the studios in Nashville. This in itself is a virtual guarantee of musical competence these days. (N.J.M.).

★ ★ ★

JOHN MACDONALD, Fireside Scottish Accordion Singalong. M7 Stereo MLX 091.

Take a well played accordion, mix it with a piano, organ and percussion backing and you have a sure-fire recipe for a good record like this one. Not all the titles fit in with the Scottish theme of the title, but one can overlook this.

The tracks are: Que Sera Sera—C'est Si Bon—Scottish Soldier—Pub With No Beer—China Doll—Those Were The Days—Volare—Help Me Make It Through The Night—The Old Northern Lights Of Old Aberdeen—I Belong To Glasgow—Moon River—I Get A Kick Out Of You—Mare Mare Mare.

As a party sing along disc it would be hard to beat and the quality is excellent. (N.J.M.)

★ ★ ★

DAN HILL & HIS MINI-KORG SYNTHESIZER. Interfusion stereo L35523.

This album of Moog grunts, whistles, wails and twangs gets the nod in spite of some negative feelings I have for Moog music. Arrangements are big, bright and have the right flavour of the ridiculous. Record quality is good.

Track titles are: Bubble Gum — Show Me The Way — Push Just A Little Bit Harder — Time Is Tight — Any Kind Bazaar — Kleine Nachtigall — Bicycle Morning — Mr Big Stuff — The Happy Frog — What Do You Wanna Make Those Eyes At Me For — Don't Break This Heart — Why Me — Red River Ride — La La La Love You. (L.D.S.)

Reubert Hayes . . . "congratulations"

FAVOURITES OF THE FORCES SING-SONG. Reubert Hayes playing the Rogers Century Organ. Stereo, M7, MLX-094.

It was some time ago that recordist Parker Oakes rang me to say that he'd just taped an exciting performance by his father-in-law, veteran theatre organist, Reubert Hayes. Now I know why he was so keen about it.

With a 3-manual Rogers "Century" electronic organ especially set up in the Civic Theatre in Newcastle, NSW, Reubert Hayes had everything going for him to record a program of the community songs that won him Australia-wide fame during the war, broadcasting from Brisbane's Regent Theatre. Remember them?

Blighty; Anchors Aweigh; Marines' Hymn—Roses Of Picardy—Tipperary; Bless 'Em All; Long, Long, Trail; Lili Marlene; Gundagai; Mexicali Rose; Home Fires—Land Of Hope And Glory. Side 2 contains two more medleys, a well played "Jealousy", "A Perfect Day" (strongly reminiscent of Jesse Crawford) and Reubert's signature theme "Beyond The Blue Horizon".

Technically, the mic. hasn't quite caught the percussion and the sound is a trifle "middly" but, as compensation, there's none of the acoustic intrusions that so often occur in recording big acoustic instruments. This is a big electronic in a real theatre and, as I listened, I couldn't help feel that it's the record that rival organ dealers might wish had never been made. The organ has the sounds of a traditional theatre instrument and, most importantly, the complex interplay of tones, and the slight variations in loudness of individual notes that make the sound sonically interesting.

Congratulations to all concerned and to M7 who organised its transcription to disc. (W.N.W.)

Books & Literature

Development technique

FROM CONCEPT TO PRODUCTION: A Management Approach, by N. G. Anderson. Published by Taylor & Francis, London, 1975. Hard covers, 240 x 155mm, 292 pp., price in UK 9.00.

At first sight it may seem inappropriate to review this book here since it is primarily a management text. However it is specifically aimed at those people who are involved in product development in the electronics industry and allied technical fields. Considering the lack of new product development in Australia, by rights it should be a best-seller.

The book is a practical guide to such topics as the establishment of procedures for development projects, planning, budgetting and expenditure control, monitoring of progress, organisational structure and personnel selection. There are several appendices which are also very useful. One on network planning makes mention of techniques such as PERT and CPA and others give specimen target specifications for typical product development programs.

Our review copy came directly from the publisher. (L.D.S.)

All about pictures

TRANSMISSION and DISPLAY of PICTORIAL INFORMATION, by D. E. Pearson. Published by Pentech Press, London, 1975. Hard cover, 209 x 152 mm, 224 pp., many diagrams. Price in UK £5.95.

A fairly advanced treatise on the fundamental principles of electronic systems designed to process, store or transmit pictorial information. It has been written primarily for communications engineers working in broadcast and cable TV, facsimile, videotelephones, computer terminals, scanning electron microscopes and similar fields, but is also suitable as a text for senior undergraduate and graduate university courses, and as a research reference work.

The material covered is shown fairly

concisely by the chapter titles: 1—The Mathematical Analysis of Images; 2—Properties of the Eye Affecting System Design; 3—Scanning; 4—Reception and Display of Monochrome Pictures; 5—Transmission of Monochrome Information; 6—Displays in Colour; 7—Transmission of Colour Information; 8—Subjective Assessment of Picture Quality. The book ends with an extensive list of references, and a topic index.

Although much of the treatment uses abstract mathematics such as Fourier Transforms, many of the basic concepts presented in the text are readily understandable by non-mathematical readers, thanks to the author's clarity of expression. The book may therefore be of interest and value even to non specialists.

The review copy came from the publisher, with no advice regarding local price and availability. (J. R.)

Now available

When the Semicon International Transistor Manual (1974 Edition) was reviewed for the April 1975 issue, no details were to hand regarding local price or availability. However we have now been informed that copies are available from Dick Smith (Wholesale) Pty Ltd of 162 Pacific Highway, Gore Hill NSW 2065. The price quoted is $28.00 plus post and packing, where applicable.

Product reviews & releases

HMV 18-inch "Braddon" colour receiver

A recent, and very popular addition to the HMV range of colour television receivers is the "18-inch" "Braddon" model 12613. Manufactured for EMI by the Japanese General Corporation, it conforms in all respects to Australian standards, and is already building up an excellent reliability record.

While obviously aimed at the lower end of the market in terms of price, the "Braddon" is in no sense a "cut-corners" design. It is housed in a neat wood-grain finished cabinet, with a front facia of matte black and satin chrome. The rear of the receiver is enclosed by a removable moulded cover, permitting direct access only to the antenna connections, the preset hold controls, and vertical height and linearity. It would obviously be a very suitable receiver for small to medium viewing situations.

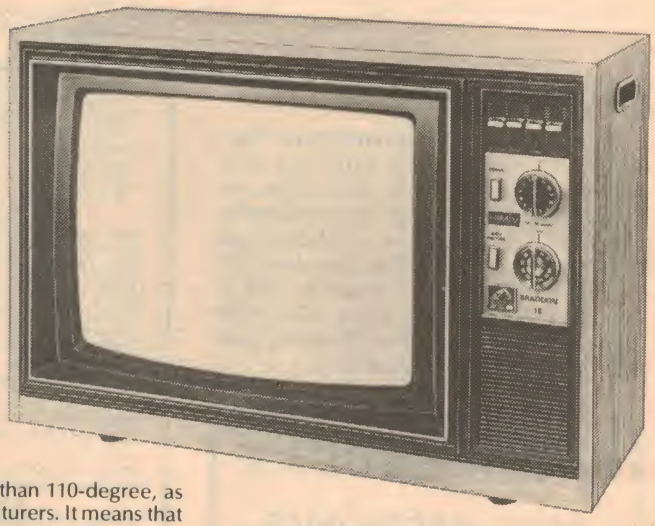
Conforming to Australian standards, it offers full PAL-D colour decoding and includes a 13-position tuner covering all existing local VHF channels, with in-built automatic fine tune. However, it also includes a UHF tuner covering channels 21 to 68, against the day when these are put into service in particular areas. As normally received, the UHF tuner feeds in via VHF channel 11 but this can readily be altered by a local technician. It involves reinserting the channel 11 coil unit, which is included inside the cabinet, and diverting the UHF tuner output to any other available channel.

Controls on the front panel include the VHF channel selector switch, the vernier tuning knob for UHF transmissions, an automatic tuning in-out switch which operates for both bands, and a power off-on. Near the top right hand corner are slider controls for colour saturation, brightness, contrast, and volume.

Aerial input arrangements also offer a maximum of convenience. For normal VHF operation, provision is made for either 300-ohm balanced (terminals) or 75-ohm unbalanced (coax. connector), with a slide switch to select the one desired. It can therefore be used with an indoor antenna (where adequate), an existing outdoor antenna, or a completely new installation. Separate terminals are provided for connection to a 300-ohm UHF antenna.

The "Braddon" receiver uses a standard delta mask picture tube. Magnetic shielding plus automatic degaussing render the set relatively insensitive to external magnetic fields. HMV's normal procedure is to unpack and check out each receiver at local distribution centres and, in particular, to make sure that purity and convergence are correct. They are then installed in buyers' homes, normally with attention only to the more superficial aspects: siting, aerial, AGC adjustment and, of course, general performance.

Of some note is the fact that the picture tube is a 90-degree type rather than 110-degree, as favoured by some manufacturers. It means that the overall depth of the receiver is greater (D-471mm, W-631mm, H-435mm), the rear of the tube protruding behind the main cabinet woodwork by more than would otherwise be the case. This would be of no consequence where the receiver is across a corner but could be a consideration where it had to stand on a shelf or against a wall.



As normally supplied, the Braddon receiver has four small buffers allowing it to be placed on a small table, or other surface. If desired, HMV dealers can arrange supply of a suitable mono-column trolley, using the same attachment screws as for the feet. This is not included in the normal price.

HMV (and the General Corporation) stress, however, that the 90-degree tube has special advantages of its own. Convergence is more easily optimised but, more importantly, much less deflection power is required to drive the 90-degree tube. This shows up as less stress on the deflection devices and a very significant saving in power consumption, and therefore heat dissipation within the cabinet. HMV see this as an important factor in the reputation for reliability which the receiver has built up already since its release on the Australian market.

Except for the picture tube itself, the circuitry is entirely solid-state, involving 4 IC's, 42 discrete transistors and 55 diodes.

Of special interest is the colour decoding circuitry, which is really a spin-off from pioneering work by the General Corporation in connection with single-gun colour tubes. Instead of the more usual phase-locked 4.43MHz sub-carrier oscillator with phase sensing and switching, the "Braddon" receiver has two phase-locked oscillators, one at 4.43MHz and the other offset by half the line frequency. By a process which would defy description in anything but a long article the two oscillators can be used respectively to resolve the B-Y and R-Y luminence components, without resorting to switching as such, and with a notably high immunity to errors caused by noise. The system is described in detail in the receiver manual and was also explained by A. Becker in "Wireless World" for January 1972.

How does the "Braddon" receiver perform? As delivered into a typical suburban home, what was classified as a "deliberately typical" unit showed good colour purity and acceptable convergence on a test pattern. Convergence errors were mainly concentrated in the corners outside the circle of a Philips electronically generated test pattern. Grey-scale tracking on the same pattern seemed to be good, although both the contrast and brightness sliders call for fairly critical adjustment to ensure proper subjective black and white.

HMV say that the receivers are adjusted before delivery to a white point equivalent to TV standard illuminant "D" at 6500K. While we did not attempt to verify this figure, the receiver did exhibit good whites although our own judgement would have been to nudge the blue gun up a trifle. There was some suggestion of chroma shift on a test pattern but it was not evident on program material. In fact, colour performance on program was excellent.

On a station-to-station basis with a quite average outside antenna, behaviour was completely satisfactory with the automatic fine tune obviating any obligations on that score. The sound was clean at all times, with no suggestion of hum or frame buzz.

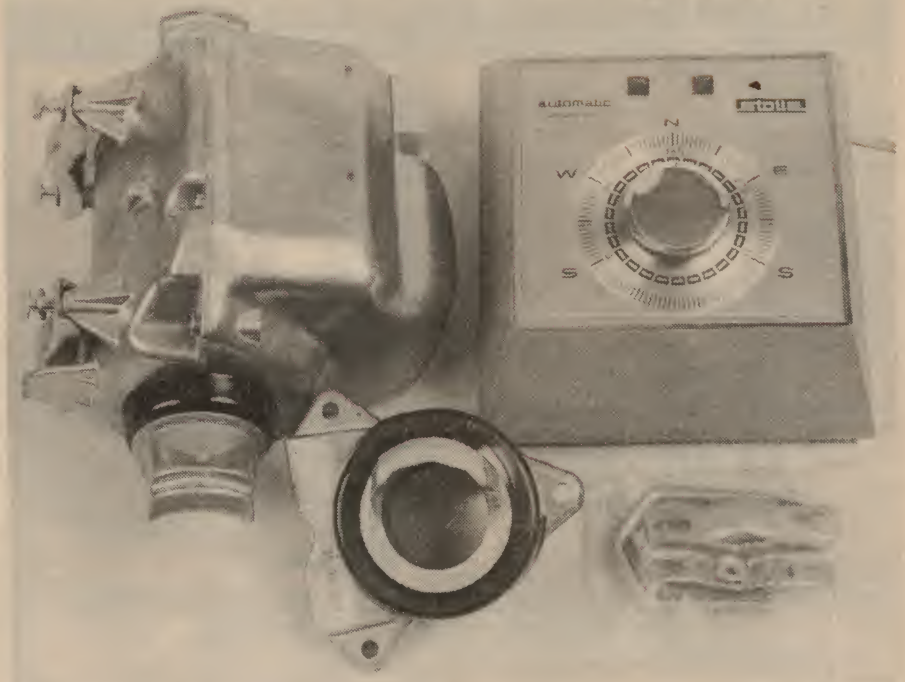
In short, the "Braddon" receiver should be an excellent proposition for any situation requiring a nominal 18-inch or 43cm (viewing diagonal) screen.

Recommended retail price for the receiver is $579, a figure which includes delivery and installation, 90 days full warranty, and 12 months warranty on the colour picture tube. Normal service contracts can be arranged with HMV retailers to cover the period beyond warranty. The distributors are aware that the "Braddon" may be offered at less than the recommended retail price and this is now quite legal and ethical. However, they stress that customers should make sure that they receive all the entitlements that are covered by the recommended figure.

Further information on the "Braddon" receiver can be obtained from HMV retailers, EMI branch offices or from EMI (Australia) Ltd, 10 Parramatta Rd, Homebush, NSW 2140. (W.N.W.)

Antenna rotator for colour TV, radio amateurs

In some areas, satisfactory TV reception in either colour or monochrome can only be achieved on all channels by using an antenna rotator. The Stolle type 2010 is an automatic unit very suitable for both TV and amateur radio antennas.



Made in Western Germany, the Stolle 2010 antenna rotator has been designed to give accurate positioning of both TV and amateur radio antennas. It will cope with antennas ranging in size up to a standard 3-element beam for the 14MHz or "20 metre" amateur band, so that it can easily cope with the largest VHF TV antennas.

In contrast with a simpler "memomatic" unit in the Stolle range, the 2010 is described as "automatic". Positive synchronisation between the control unit and antenna positions is ensured by means of a balanced-bridge servo circuit. As a result the two cannot get "out of step", and do not require periodic resetting.

The antenna drive unit is housed in a very sturdy casing of cast aluminium alloy, which is fully waterproof. The drive shaft is also a casting, with the final gear an integral part of the casting so that it cannot come loose. The shaft is hollow, and designed to take antenna masts up to 38mm (1½in) in diameter. It is also double-ended, to allow the rotating mast to be clamped at both top and bottom of the drive unit for greater resistance to the various forces exerted by windage.

Inside the drive unit the rotator uses a worm drive for the final transmission, to minimise windmilling. The motor also has a positive disc brake system, to prevent coasting overshoot. The reduction gear chain features an overtravel clutch to allow the motor to gain momentum before the load is engaged.

The control unit is housed in an attractive case moulded from impact resistant plastic. It has the position command knob as its single control, turning through an angle of approximately 270 degrees —but calibrated for the full 360 degrees of rotation provided by the drive unit. The direction of antenna rotation is indicated by indicator lights, which extinguish when the antenna reaches the position dialled. Time for a full 360 degrees of rotation is approximately one minute.

The motor shaft bearings of the drive unit are lubricated for life. Motor drive voltage is a nominal 42V, so that the cable between the control and drive units carries no dangerous voltages. Total power consumption of the system is 60W.

The Stolle 2010 comes with four toothed mast clamps, two for attaching the drive unit to the main mast and the other two for attaching the rotating mast using two U-bolts supplied also.

Probably as a result of its German origin, the unit is designed for nominal 220V mains and no provision appears to be made for adjustment. However the supply is automatically disconnected from the power transformer in the idle state, and this, together with the intermittent mode of operation in typical service, should mean that overheating is unlikely even where the mains voltage rises to 250V or more.

An optional extra available for use with the Stolle 2010 is an auxiliary thrust bearing, to allow the unit to cope with very heavy amateur antennas.

Also apparently regarded as an optional accessory is the 5-core cable required to interconnect the control and drive units; such a cable is not supplied as part of the basic system, even though it won't work without one. This seems a rather odd use of the term "optional", although it would no doubt be difficult to decide upon a "standard" cable length.

Local agents for Stolle are R. H. Cunningham Pty Ltd, of 493-499 Victoria Street, West Melbourne, Victoria and 4-8 Waters Road, Neutral Bay, NSW.

Cordless iron from scope

Designed and manufactured by Scope Laboratories in Melbourne, this new cordless soldering iron uses the same heating element, tip and barrel as their well-known Superspeed irons. Operating from two internal nickel-cadmium D cells, it is claimed to perform from 100 to 400 joints on one charge, with recharging in about 14-16 hours from a car battery, optional power supply or an existing "Scope" iron transformer.

The iron uses a trigger switch, and provides 60 watts of tip heating. The case is designed to counterbalance the two relatively heavy batteries, for convenience and minimum operator fatigue.

The Scope Cordless 60W iron comes complete with a spare tip and element, and an instruction book. Distributed by IRH Components, a division of Natronics Pty Ltd, it should be available from electronic wholesalers and retail outlets together with major hardware stores.

NEW PRODUCTS

Cordless PC drill

Designed for convenient drilling of PC boards for prototype and small-scale production work, the Mini Drill model D2 is a hand-held unit operating from four internal penlight cells (type AA or UM3). It weighs 270 grams including the cells, and measures 181mm long by 41mm diameter.

Nominal drill speed is 2500rpm, and the collet-type chuck will take drills from 0.6 to 1.5mm in diameter.

Motor torque is only modest, but is quite adequate for drilling both phenolic and glass laminate PC boards. The D-2 is also suitable for aircraft modelling, detail engraving, jewellery, etc. It comes complete with a combination centre punch and chuck tightening pin, and a 1mm drill, for $15.75 plus 75c post and packing where applicable.

Optional accessories include a mains power pack adapter and a small bench stand (type STD-50). The stand is priced at $8.50, again plus 75c post and packing where applicable.

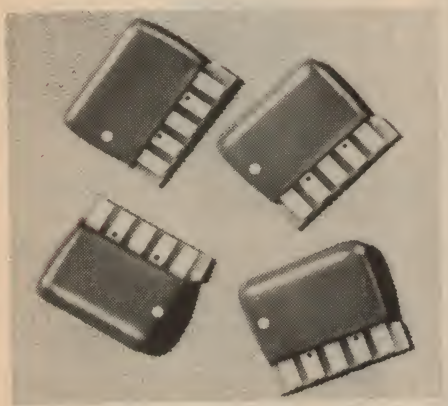
Available from Dick Smith Electronics Pty Ltd, 176 Pacific Highway, Gore Hill, NSW 2065.

Mini slide switches

These new miniature slide switches for PC board mounting are designed primarily for programming or test switches. They feature a low profile case, epoxy sealed terminal pins and gold flashed contacts and terminal pins. Top and side lever versions are available, in both SPDT and DPDT configurations. Namco Electronics, 239 Bay St, North Brighton, Victoria.

Balanced mixer

Designed for mass usage applications such as TV tuners, FM tuners, mobile radio and CATV converters, the Hewlett-Packard model 5082-9200 printed circuit balanced mixer covers the range from DC to 1200MHz, with a local oscillator range of 100MHz to 1200MHz. Conversion loss is 6.5dB; isolation is 45dB at 200MHz, 25dB at 900MHz. The 2nd order

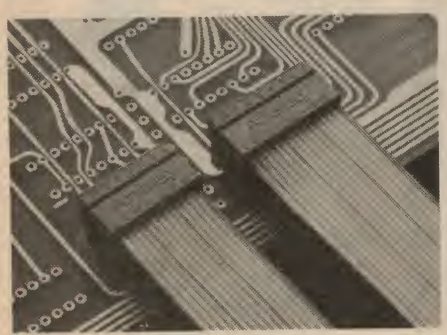


distortion intercept is +38dBm, and its 3rd order intercept is +23dBm.

The mixer contains two Schottky diodes and a PC transformer. It costs less than $2 in 100k quantities. Hewlett-Packard Australia Pty Ltd, 31-41 Joseph Street, Blackburn, Victoria and branches in each state.

DIP connector

A new series of solderless one piece DIP plug connectors is designed for terminating flat cable to DIL sockets. Both 14 and 16-pin versions are available, from Ansley Electronics division of Thomas and Betts, PO Box 91, Brookvale NSW 2100.



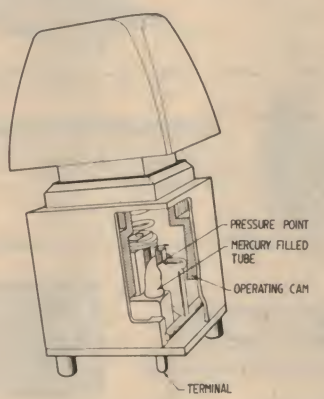
Low profile relay

A new range of low profile PC board relays, series 1005, offer rugged construction and trouble free operation. The contacts may be wired to provide either a double make double break or SPDT configuration. Coil sensitivity is 900mW, with versions for nominal coil voltages of 6, 12, 24 and 48V DC. The contact rating for resistive circuits is 1200VA, with a voltage rating of 240V AC or 125V DC, and a current rating of 6A. Overall size with dust cover is 35.6 x 16.5 x 10.8mm.

The relays are manufactured by Hi-G D'Italia SPA, and available in Australia from A. J. Ferguson Electronics, 29 Devlin Street, Ryde NSW 2112.

Mercury keyswitch

The new M-5 version of the well-known Mercutron keyswitch uses a small cam-operated actuator to provide more precise and reliable operation than previous versions. The switch operates in any position, is absolutely bounce free, and is rated at 200mA/24V DC with a rise time of less than 10 nanoseconds. A



complete line of keyboards in all levels of complexity is available using the M-5 switch, which is available in either single or double pole and NC or NO versions.

Made by Mechanical Enterprises, Mercutron switches are available here from General Electronic Services of 99 Alexander St, Crows Nest, NSW 2065.

Semiconductors

Paradio Electronics announce that they are now sole Australian agents for Best Semiconductors Ltd of Hong Kong, and can offer good stocks of a wide variety of silicon transistors and diodes assembled in Hong Kong from US chips. Devices include BC147-8-9, BC157-8-9, BC327/337, BA222 and other low power devices. Trade enquiries are welcome. Paradio Electronics, of 7a Burton St, Darlinghurst, NSW 2010.

L.E. CHAPMAN

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Magnavox 5 inch dual cone Tweeter	$6.00
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MSP 3 inch 8 W 15 ohm	$3.50
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3.5 to 3.5 Jack Plugs 7 ft. Shielded Cable 75 cents
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Hook Up Wire 30 mixed colours lengths $1 bag.

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Electros 3-in-one: 20, 400, 450, 10, 400, 450, 75, 50, 65. $1.00

AWA 11 inch P.I. TV EHT transformers $5.00

Car Converters: 12 volt to 6-7.5-9 volt 500 MA $6.00

Microphones—Dynamic 10k $3.50

Valve Sockets: 7 or 9 pin 10 cents. Octal 10 cents

Speaker Transformers: 6 Watt 7000 to 8 ohm $2.50; 3½ Watt 7000 to 15 ohm $1.75; 6 Watt 7000 to 1k $2.50; 500 to 27 ohm 50 cents.

Ferrite Rods 6 inch 50, 9 x ½ 75 cents

Pots:
10K ganged log 50 cents
1 Meg ganged log $1.25
½ Meg ganged log $1.25
2 Meg ganged log $1.25
2 Meg double pole switch $1.50

Sharp TV Flyback Transformers 8FT 604 $7.00

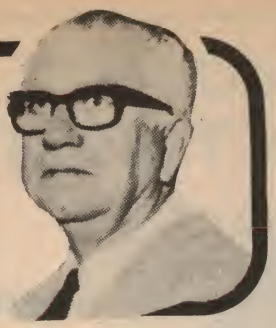
Miniature Speaker Transformers, drive and output $1.00 pair

Heat Sinks: 4 x 2 1¾ $1.50

Universal Mono Pick-up Cartridges: fit most type record players $3.50

The Amateur Bands

by Pierce Healy, VK2APQ



The Australian repeater scene

The establishment and use of repeaters on the amateur bands has provided a technical challenge as well as a useful means of communication.

Since the use of amateur repeaters was first permitted on the 144MHz to 148MHz band in 1968, there has been many arguments among various individuals and groups about the frequencies to be used. However, during the past eighteen months the situation has stabilised and the frequencies used, with two exceptions, are in unison with the WIA band plan. Both the exceptions are awaiting:

(a) A decision on the change to television channel 5A in the area served by the repeater.

(b) Official approval to change from the existing frequencies in use.

To overcome difficulties caused by over-lapping service areas of repeaters on the same channel, changes from the original allocation has, in some cases, been necessary.

Also an increase in the number of channels originally planned, may be necessary in some areas to give adequate coverage and to cope with the increasing traffic.

Technically, development of the repeater systems has involved relatively few amateurs in the design, construction and maintenance of the units. In most cases the task has been undertaken or coordinated by groups within clubs. There has been a gradual decrease in the modification of disposals units and an increase in construction using solid state components and techniques.

Unlike the majority of repeaters overseas, the repeaters in Australia offer "free access" to anyone with the appropriate crystals. The use of a coded signal is not required to activate the repeater. The latter method is designed to limit repeater access to members of the group or club who own the installation.

Another point of interest is that, in accord with a recommendation by the licensing authority, applications to install a repeater are made through the WIA.

Although it has been emphasised that the main object of the repeater system was to assist mobile operation, DX working between home stations is also a feature of the system.

One beneficial trend which seems to have developed where repeaters are installed is a convention whereby base stations monitor the repeater channel rather than the simplex channels. The reason is that the range of the repeater circuit is potentially much greater and is therefore the logical channel for mobiles to use when approaching an area. The result is that immediate contact is generally assured.

The following repeater table has been prepared from information supplied by George Francis, VK3HV, publicity officer, Victorian Division WIA repeater committee, and several other sources. The information was that known as at 21st September, 1975. However, details of any additions or amendments will be appreciated and included in future notes.

The table lists the principal details of Australian repeater facilities

a. Those operational

b. Those proposed, in course of construction, or awaiting licence.

The details for Newcastle and Gosford shown in brackets will supersede those currently being used and are dependent on satisfactory tests and administrative approval.

Likely call signs are shown in brackets and the asterisk indicates final testing before being placed in service.

Call Sign	Area	Channel	MHz In	MHz Out
VK1RAC	Canberra	3	146.3	146.9
VK2RAB	Tamworth	6	146.25	146.85
VK2RAN	Newcastle		146.4	145.9
		(3)	(146.3)	(146.9)
VK2RAG	Gosford		146.1	145.6
		(5)	(146.15)	(146.75)
VK2WI/R1	Sydney	4	146.4	147.0
"	Temporary alternative channel		146.4	145.9
Vk2RAO	Orange	1	146.1	146.7
VK2AMW/R	Wollongong	6	146.25	146.85
VK3RMA	Mildura	4	146.4	147.0
VK3RAM	Bendigo	2	146.2	146.8
VK3RML	Melbourne	1	146.1	146.7
VK3RGL	Geelong	4	146.4	147.0
VK3RLV	Latrobe Valley	2	146.2	146.8
VK3RWZ	Western Victoria	7	146.35	146.95
VK4RAT	Townsville	1	146.1	146.7
VK4RGC	Gold Coast	1	146.1	146.7
VK4RAI	Ipswich	3	146.3	146.9
VK4RBN	Brisbane	4	146.4	147.0
VK5RAD	Adelaide	4	146.4	147.0
VK6RAP	Perth	1	146.1	146.7
VK6RAA	Albany	2	146.2	146.8
VK7RAA	Mt Barrow	4	146.4	147.0

b. Repeater installations are also planned for the following areas.

VK2	Lismore	4	146.4	147.0
	Coffs Harbour	2	146.2	146.8
	Pt Macquarie	1	146.1	146.7
	Blue Mountains	7	146.35	146.95
	Ulladulla	3	146.3	146.9
	Wagga Wagga	5	146.15	146.75
VK2—*	Engadine	2	146.2	146.8
(VK3RNE)	N.E. Victoria	4	146.4	147.0
VK3RMV*	Swan Hill	3	146.3	146.9
(VK3RBA)	Ballarat	5	146.15	146.75
(VK3RMM)	Mt Macedon	6	146.25	146.85
(VK3RAP)	Hamilton West	1	146.1	146.7
VK3REG*	East Gippsland	3	146.3	146.9
VK4	Sunshine Coast	—	—	—
	Rockhampton	—	—	—
(VK5RAA)	Pt Pirie	1	146.1	146.7
VK6RAH*	Perth	2	146.2	146.8
	Wagin	4	146.4	147.0
	Kalgoorlie	—	—	—
VK7	Hobart	1	146.1	146.7
	Loana	—	—	—

To celebrate the Royal Australian Corps of Signals 50th anniversary, members of the 2nd Signal Regiment will install and operate an amateur station at the Watsonia Barracks, Melbourne, from November 3 to 10. Picture shows (L to R) Major Darryl Slade, Corporal Robert Linton and Sergeant Barrie Edwards planning the location of aerials for the station. (Story P101)

SUGGESTED WIA UNDERTAKING

The future of amateur radio societies, in particular the WIA, and the financial difficulties being experienced, has spurred at least one amateur, Don Watson, VK4DZ of Townsville, Queensland, to put forward a sound proposal.

Extracts from a letter he wrote to the Council, Qld Div, WIA (copies to WIA Federal Executive, all federal councillors, and the editor of "AR") are given here, as, to quote Don, "... the proposal must have the widest possible spread among the amateur fraternity in Australia. This includes non-members of the WIA.

"I have read with interest and concern the various reports in 'QTC' and 'AR' on the state of the Institute's finance.

"The problem, being a national one, is considered on a national scale rather than a divisional one. The problem itself is a simple one—the WIA has a deficit of some $16,000. The cause is equally simple—'the WIA exists to provide a service for its members' (AR May 1975).

"The effects of inflation cannot be countered by operating on a fixed budget drawn up some eight months before the Institute's financial year. This can only be done if, as in any trading organisation,

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown 2200.

increasing costs are passed on as they occur. In its present form the WIA has nowhere to pass these costs, other than to its members in the form of increased subscriptions or levies. The only profitable side of the Institute's activities has been the sale of publications. It would be pretty unreasonable to expect this facet of operations to be able to cope with a $16,000 deficit, nevertheless the lesson should be sufficient to bring home the fact that the Institute can only hope to meet the costs of the services sought by members if it can increase its income by means of a trading subsidiary.

"I doubt that the investigation to be undertaken by VK3ZBB into 'the whole of the systems and services of the Institute from top to bottom' will arrive at any worthwhile recommendation for reducing expenditure, and agree with the comment in the Executive Annual Report 'that if the office is to provide the service to the Institute that council expects of it then there is a limit to the economies which we can apply'.

"With this in mind, therefore, it is suggested that the WIA implement the incorporation of a wholly owned trading subsidiary. If the proposal is contrary to the WIA constitution, then amend the constitution to provide for it.

"At present the WIA has a membership of some 4500. There are some 6850 licensees. The advent of novice licensing will probably raise this number to 8000 within twelve months. The WIA serves the interest of all licensees, whether members or not, yet it gains no financial benefit from the business generated by these licensees. I recollect a survey undertaken some four or five years ago (or was it longer?) which indicated that each amateur spent an average of $15 per head per year on miscellaneous equipment (excluding one major purchase such as transceivers). No doubt the figure would be higher due to the effect of inflation, but 8000 x $15 gives a sales potential of $120,000 pa, plus major equipment. It would be foolish to suggest that the whole market could be captured by anyone, but nevertheless there is room for the Institute to enter the market, and to gain some financial benefit from the activities of its members.

"It is realised that the proposal may run contrary to the vested interest of those divisions which undertake a form of trading activity, and indeed contrary to the interest of quite a few members themselves. Nevertheless, the financial future of the Institute is equally as important as that of divisions and individual members, and any argument to the contrary should not be allowed to sway a decision.

"The project will need capital. This could be raised by the sale of shares to members and or by debentures. If 4500 members were to contribute an average of $20 per head in shares or debentures this would raise $90,000. Easily said, not so easily raised. The idea would need to be sold to members on the basis that a successful operation would allow a reduction in the present annual subscription rate, as well it could. Better an investment than a yearly contribution.

"The project, if it is to get off the ground, would need to be able to compete with other dealers and indeed offer incentives to members or shareholders by way of discounts. This would induce further membership from non-members, thus contributing to Institute revenue.

"The WIA, by virtue of its connections, should be able to arrange agencies for sale of almost every brand of equipment, and whilst at the outset activities may be limited to amateur radio lines, it should be the aim to extend generally into the field of electronic equipment. This in fact would be highly desirable even at the outset, as it would be difficult to hold and defend a small segment of the electronic market when competitors have advantages accruing from profitable volume sales in the whole field.

"Without a commercial means of revenue the Institute faces bankruptcy in the foreseeable future. With this in view, it is considered that there is scope for the WIA to participate in the market which it serves to protect, and to compete profitably to such an extent that the cost of services provided to mem-

bers can be covered to the mutual benefit of the Institute and its members."

A point to note is that Don Watson is well qualified to analyse and advise on such a problem. In his work-a-day life he is in close touch with the world of finance which deals with far greater amounts than the WIA or any other amateur radio society would expect to become involved in.

Therefore, the proposal merits deep consideration and positive investigation.

What is your considered opinion?

RADIO CLUB NEWS

UNSWARS CHRISTMAS VACATION ACTIVITIES

To assist interested persons to obtain a novice licence, the University of NSW Amateur Radio Society has arranged a program of study activities.

There being no minimum age limit set for the novice licence, all ages will be catered for. Encouragement is also being given to the participation by ladies in the study groups.

Activities will cover theory, regulations and Morse code practice. A study of the social and cultural aspects of amateur radio, practical constructional projects and field excursion trips will also be included.

The first meeting will be held on Saturday 13th December, 1975 at the Wireless Institute Centre, 14 Atchison Street, Crows Nest (near St Leonards Railway Station) at 7.00 pm. Assistance will be given to solve transport difficulties.

Activities will normally take place from 6.00 pm to 9.00 pm each Tuesday, Thursday, Friday and Saturday concluding on 26th January, 1976.

The only fee involved is $5.00 to cover printed material.

All activities are on a voluntary basis and assistance from those interested in helping will be welcome.

No previous knowledge of radio theory is necessary to attend the classes. Enrolment may be made at the first meeting it is convenient to attend. Those wishing to assist should write to the University of NSW Amateur Radio Society, Vacation Activities Group, The Union Box 57, PO Box 1, Kensington, NSW 2033.

WAGGA DISTRICT RADIO CLUB: At the annual general meeting of the Wagga District Radio Club the following office bearers were elected: President, John Eyles VK2YCM. Vice-president, Warren Williams VK2ZGN. Secretary-treasurer, Jeff Lane. Committeemen, Sid Ward VK2SW. Doug Meneke, VK2ZMP. Jeff Brill.

For details of club activities contact Jeff Lane, 274 Lake Road, Kooringal, NSW 2650. Telephone (Bus) Wagga 211833.

MOORABBIN AND DISTRICT RADIO CLUB: At the August general meeting of the MDRC there was good news on the proposed combined club rooms.

The Moorabbin Council has set aside an additional $20,000 for the building. That amount, plus the $46,000 allocated in 1974, plus the $7500 contributed by the combined clubs, makes a total of $73,500.

It is understood that building plans have been finalised and tenders for the construction would be called for before the end of August. It is anticipated that the new building will be completed early in 1976.

EASTERN ZONE VICTORIAN DIV. WIA: The annual meeting of the Eastern Zone was held on 30th August, 1975 at the Gippsland Institute of Advanced Education, Churchill. The activities of the zone during the past twelve months was outlined in a report by the president Ted Allchin, VK3YGI. These included the promotion of amateur radio through the Central Gippsland YRCS at Traralgon and Traflagar also at Warragul under the Adult Education Scheme. It was reported that 25 candidates are ready for the first novice licence examination.

Ted also reported considerable activity in updating and resiting the Latrobe Valley repeater and the construction of the East Gippsland repeater. The Eastern Zone hookup on 3650kHz each Sunday night at 2030 hours has continued with various stations taking part.

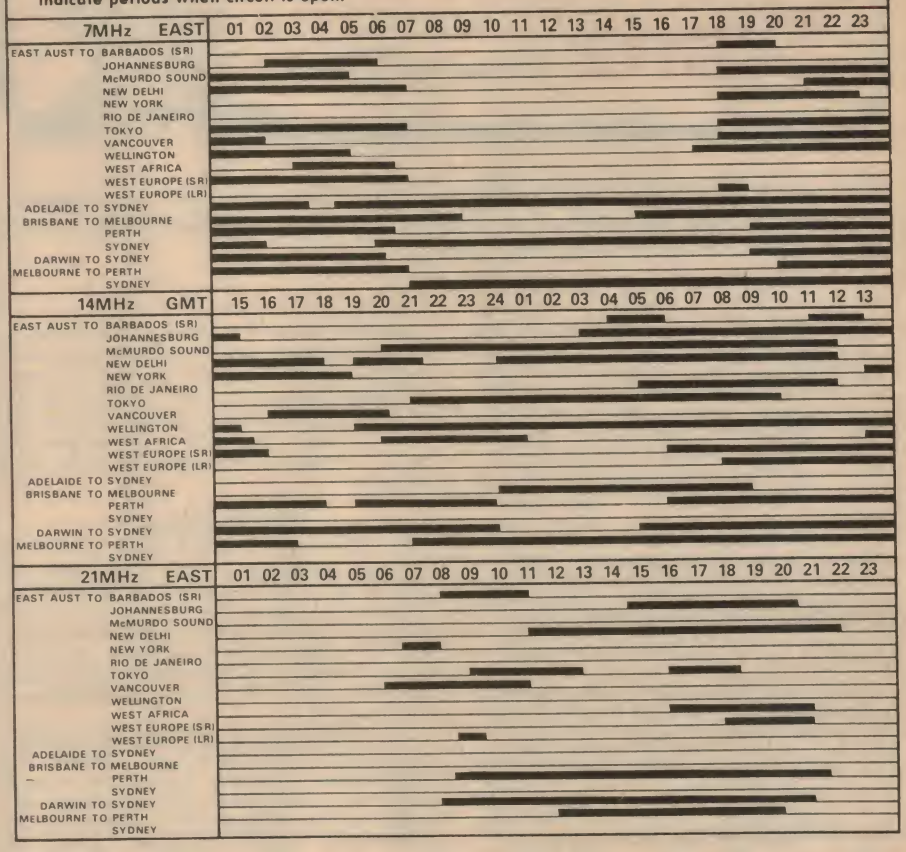
It was announced that Gregor Cox, VK3ZGC, was the winner of the 1975 Eastern Zone Activity Award. Other subjects discussed were the Wildcat DX Award; the Eastern Zone Newsletter; working bees for the Latrobe Valley repeater; testing of the East Gippsland repeater on channel 3 and the Morse code practice sessions each Tuesday evening.

Office bearers elected for the coming year were: President, Ted Allchin VK3YGI. Vice-president, Bruce Hocking VK3ADB. Secretary-treasurer, Harold Hardy VK3YGJ. Repeater Officer, Graham Colley VK3QZ. Activities & Publicity Officer, Bob Sherlock VK3APV. Station Officer, David Scott VK3DY. Asst Station Officer, George Francis VK3HV. WICEN Co-ordinator, Keith Scott VK3SS.

Guest speaker for the evening was Mr Paul Strickland, spokesman for the Gippsland Institute of Advanced Education newly-formed FM broadcasting group. Paul outlined the function of the station, which will broadcast fine music, educational and public access programs. Amateurs in the area were invited to assist in the construction and provide technical assistance in the operation of the station. Being a non-profit organisation, Paul explained that donations of equipment or money would greatly assist the project.

IONOSPHERIC PREDICTIONS FOR NOVEMBER

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 11.75



SIGNAL CORPS JUBILEE

The 50th anniversary celebrations of the Royal Australian Corps of Signals, will be held throughout Australia from 3rd to 10th November, 1975. Members of the 2nd Signal Regiment will install and operate an amateur station at Watsonia Barracks, Melbourne during that period.

A display of army signals equipment will be open for public inspection on the 8th and 9th November. The Governor General will open the display on the 8th.

The amateur station, under the supervision of full call licensees and manned by members of the Signal Corps, will operate from 3rd to 10th November inclusive. The call sign specially allocated for the occasion is AX3SIG and will be used only for the duration of the celebrations. The station will be operated for 24 hours each day on all HF amateur bands from 160 metres, and on two metre simplex and repeater channels for VHF operators in Melbourne.

Standard service equipment will be used in the station installation. Among the supervisors holding amateur licences will be Lt John Loftus, VK3QK, Lt Col John Bennett, VK3ZA and Surgeon Captain Jim Lloyd, RAN, VK3CDR.

The station will run 50 watts AM on 160 metres and 400 watts upper side band on all other HF bands. CW will also be used and it is hoped that RTTY will be used.

A special QSL card has been printed and it is hoped that world wide contacts will be made. The station will be part of an amateur hookup of signal corps divisions throughout the world.

Shortwave Scene

by Arthur Cushen, MBE

The success of the Radio South Africa External Service, which was opened in 1966 with four transmitters of 250kW, has been such that three further transmitters of 500kW are to be installed.

Radio South Africa has announced that the South African Broadcasting Corporation (SABC) has authorised the installation of three additional 500kW transmitters at the HF Verwoerd Transmitting Station. Extensions to the buildings will be necessary to accommodate the new equipment, and new antennae arrays for the transmitters will be erected. The project is in its preliminary stages and thus far, no date has been set for the transmitters to become operative.

At present Radio South Africa uses four transmitters of 250kW, which were opened May 1 1966. They are located at the HF Verwoerd Transmitting Station at Bloemendal, some 45km south of Johannesburg. The transmitters are operating with programs for 156 hours a week and broadcasts are carried in 10 languages.

As well as serving Africa, transmissions are beamed to Europe and North America. A service to Australia and New Zealand operated for four years, but was withdrawn due to the difficulties providing a reliable signal into this area. Several transmitters of 100kW are also located at Bloemendal and these carry the internal programs for reception in Southern Africa. The tropical bands are used for this purpose.

We visited the transmitting site in 1969 and found it to be one of the most modern in the world. At that time a huge new studio building was being built at Auckland Park, a Johannesburg suburb, and this is now complete and houses the radio and television services.

The SABC has 19 different program services which cover English, Afrikaans, and the Bantu languages. Some 86 stations operating on FM provide most of this service.

VOICE OF MALAYSIA

A powerful signal from the Voice of Malaysia at Kuala Lumpur has been heard on 15275kHz with an English transmission to 0850GMT. The broadcast is on the air from 0625GMT on 15275kHz and 6175kHz. According to the closing announcement the transmission continues in Indonesian on 6175kHz up to 1600GMT.

Our reception on 15275kHz has included the interval signal up to 0900GMT and then a program in Indonesian. It is understood that a new high-powered 500kW transmitter has been installed in Sabah, and this could be the reason for the stronger signals on this frequency.

NEW BOGOTA FREQUENCY

Radio Nacional at Bogota Colombia has been heard on 15335kHz with a relay of the Nacional program around 0200GMT. This frequency, previously inactive for some months, is giving good reception in New Zealand until close down at 0400GMT. On Mondays the program consists of classical music with a three note chime at 0200GMT and full station announcement.

According to the New Zealand DX Times the station has been heard with a session of English lessons and transcription programs provided by Radio Nederland. During the week news in Spanish has also been observed at 0200GMT. The call is HJZP and the power is 20kW. Nigel Robins of Wellington and Bruce Cavanagh of Invercargill both report good reception.

KGEI SCHEDULE

The November schedule for station KGEI at San Francisco shows that Gospel transmissions are beamed both to Asia and Latin America on two transmitters. The transmission to Asia from 0700-0900GMT is carried on 5980kHz with 50kW, the first hour of the broadcast being in English. The power of 250kW is used for the balance of the transmission from 0900-1400GMT on 5980kHz, with English from 1000-1100GMT.

Transmissions to Latin America are 2130-0030GMT on 15280kHz, 0030-0200GMT on 11905kHz, and 0200-0700GMT on 9615kHz, all using 50kW. A further service from 0900-1500GMT on 9615kHz also uses 50kW. The 250kW transmitter is used from 2330-0100GMT on 15355kHz, and carries German and Spanish programs beamed to Latin America. The station address is: Radio KGEI, Box 15, San Francisco, California, 94063.

SW CLUB ENDS

The Radio Canada Short Wave Club was terminated this month after being on the air for the past 14 years. The broadcast carried on a Saturday evening transmission was originally conducted by Basil Duke, but in later months has been compered by Ian McFarland. In addition, the club produced a bulletin for its members and, over the years, broadcast several interesting series, including one on foreign station identification and another on the different types of interference.

Another session to be withdrawn on November 2 was the Listeners Corner, which has also been a long running program and best remembered by its compere, Earle Fisher. This was broadcast on Sunday evenings, but in recent months was part of the Saturday broadcast being featured with the Short Wave Club.

MAJOR BRAZILIAN CHANGES

There has been a tremendous increase in the number of stations in Brazil in the past few years, and this has forced the authorities to make many frequency changes for stations using the lower channels in the 90 and 60 metre bands. It has also been announced, according to the BBC Monitoring Service, that Brazil is undergoing a massive change in broadcasting with the licensing of 379 additional stations, bringing to 1170 the number of medium-wave broadcasters operating out of 861 cities.

Radio Nacional de Brasilia has only one 250kW transmitter in operation, and it is beamed to Europe only. A second transmitter has arrived from Switzerland, and will be used for North American broadcasts. The broadcast to Europe continues to be well received on 15245kHz with English from 2100-2200GMT. The address of Radio Nacional de Brasilia is PO Box 07/0173, Brasilia.

INDONESIAN NEWS

The interest in signals from Indonesia is shown by the reports of many readers who are hearing stations from this part of the world. RRI Kupang, Timor has been heard on 3385kHz after 1400GMT when the Papua-New Guinea station Radio East New Britain leaves the frequency. RRI Palangkaraya, has been heard by Craig Tyson, Wembley, WA , with station identification at 1333GMT on 3905kHz. Our reception at this time showed the station to be carrying a program of light classical music on Sundays.

RRI Fak Fak, using 4789kHz has station announcements at 0958GMT. RRI Sibolga, is reported on 5260kHz in "Down Under DX News" as operating on this frequency from 1000-1600GMT. RRI Pakanburu, has been heard on 5886kHz closing at 1558GMT. The same program is carried on 5205kHz and the schedule is 1000-1600GMT.

MEDIUM WAVE NEWS

PHILIPPINES: The new 250kW transmitter of the Far East Broadcasting Company at Iba, Zambales, in Northern Luzon has been heard on 1470kHz at 1400GMT. This station broadcasts to Hong Kong, South China and South East Asia. The signal at our location was fair, but we are receiving it on the back of the beam, and as well there is considerable interference from Chinese and Thai stations on the same frequency. The program consisted of recorded Gospel music with announcements in Chinese. Reports should be sent to the Far East Broadcasting Company, PO Box 2041, Manila, Philippines.

QATAR: According to the BBC Monitoring Service the new station in Qatar on 952kHz uses the power of 750kW. Reception is possible around dawn. The station is located at Al-Quraysh in the northern coastal area.

AUSTRALIA: Further expansion of medium-wave and FM services in Australia was recently announced, and this includes plans for nine FM stereo stations and three medium-wave stations. The medium-wave stations are to be licensed to universities and other institutions of learning on a twelve month experimental basis, according to DX Post of Adelaide.

The medium-wave stations are to be given to: Darling Downs Institute, Toowoomba; the National University, Canberra; and the West Australian Institute of Technology. The stations, mainly in provincial regions, will provide adult and teacher education programs, as well as cultural broadcasts.

LISTENING BRIEFS

EUROPE

MALTA: Broadcasts from Malta on 9755kHz have been heard at 2045GMT on Saturdays. These are beamed to the United Kingdom, using the transmitter of Deutshce Welle. The station was also heard to carry Gospel programs for the Voice of Hope and Ibra Radio after 2100GMT, and it is thought that these are aimed at Portugal where there have been serious political disturbances.

GERMANY: According to "Sweden Calling DXers," broadcasts from RIAS, Berlin, on 6005kHz are now from two different transmitter locations—at 0325-1730GMT from a 20kW transmitter in West Berlin, and at 1730-0315GMT from a 100kW transmitter in Munich. This change took place recently. Reception reports are requested, and will be verified by a card with a picture of the station.

ASIA

THAILAND: Radio Thailand, Bangkok has been heard on 9655kHz with an English announcement at 1024GMT prior to commencing their external service. Craig Tyson, of Wembley, WA, reports fair reception of this transmission.

KOREA: Recently we reported reception of a Korean signal opening at 0900GMT on 6348kHz, with news at 1000GMT. This signal was first noted by Steven Greenyer of Invercargill. According to a listener in Japan, the station is known as 'Radio Echo of Hope.' It has no connection with the former Korean Army Station 'Voice of Hope,' and is presumed to be broadcasting from South Korea. The present schedule is: 0200-0500GMT, 0900-1200GMT, and 1230-1530GMT, all on 6348kHz.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT, add 9 hours for West Aust. Summer time, 11 hours for East Aust. Summer time and 13 hours for NZ Summer time.

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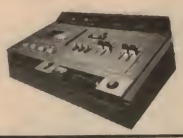

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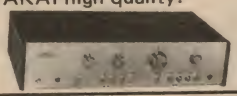

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C90 LN	2.20	2.00	1.80
C120 LN	2.95	2.80	2.65
CDC 60	2.35	2.14	1.93
CDC 90	3.10	2.90	2.60
CDC 120	3.95	3.80	3.65

MEMOREX MRX2	1	12	24
C45	2.10	2.00	1.90
C60	2.30	2.15	2.00
C90	3.20	3.00	2.80

TDK	1	12	24
C45 LN	1.80	1.70	1.60
C60 LN	1.95	1.85	1.75
C90 LN	2.80	2.60	2.40
C180 LN	5.45	5.30	5.05
C90 SD	3.65	3.45	3.25

CONCORDE	1	12	24
C60	1.20	1.10	1.00
C90	1.60	1.50	1.40

SONY			
C90 LN	2.55	2.25	2.05

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$35.00
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$1 cartage to rail. Freight payable at nearest attended railway station.

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P & P A. $1.55, B $1.60
C. $1.95, D. $2.75.

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4 bank 25 position **$4** each.
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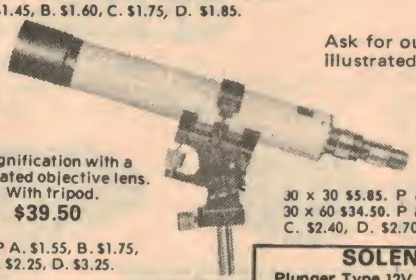

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INFORMATION CENTRE

QUADRADISCS: I am writing regarding Quadradiscs. Can they be played on a stereogram and a 4-channel gram without damaging needle, record or record player?

On the cover of Quadradiscs they state Compatible with Mono and Stereo but I want to know about playing it also on 4-channel matrix. (G. R., Kadina, SA).

● CD-4 discs can be played on any equipment using a cartridge of high compliance. Any cartridge with a playing weight of more than 2 grams will cause undue wear of the high frequency carrier after only a few playings and will thus render them unusable for 4- channel reproduction on equipment having an inbuilt CD-4 decoder. Unless you are particularly interested in the music available on CD-4 discs and intend changing to full CD-4 operation in the near future, there seems little point in buying them.

PLAYMASTER No 1: Early in the sixties I put together a stereo radiogram using a Dual automatic turntable and a Playmaster amplifier and separate tuner. For the latter two units I used assembled items. As the turntable had to be replaced I have invested in a Pioneer PL-12R stereo unit. The amplifier and tuner are operating very well and I see no reason to replace them at this juncture.

My problem, as I am not a radio or electronics expert, is how to connect the turntable to my amplifier so that I can get some stereo music. Beyond supplying you with the enclosed sketch I am unable to identify the Playmaster amplifier. I have tried as many combinations of connecting the amplifier as I can think of but to no avail. Your advice would be appreciated. Is the PL-12E compatible with this Playmaster amplifier? (J. D., Strathfield, NSW).

● Your last question is the crux of the matter, J.D., and the answer is no. From your sketch, it seems very likely that your amplifier is a version of the Unit Playmaster No. 1 published in April, 1960. This amplifier was intended for use with cartridges and does not have anywhere near enough gain for your new turntable which uses a magnetic cartridge. If you wish to continue to use your old amplifier you will need to build or buy a suitable preamplifier. The "Low Noise Preamplifier" published in September, 1971 (File 1/PRE/26) is suitable and quite economical.

SSTV MONITOR: Today I picked up a copy of the October 1974 issue of EA and noticed in the Information Centre a letter from G.G. of Lake Heights, NSW concerning SSTV.

I am a member of the British Amateur Television Club and interested in SSTV. The book recommended to me covering this subject is the 1973 publication by Don Miller W9TNP and Ralph Taggart WB8DQT called "Slow Scan Television Handbook". It contains 248 pages and covers all facets of SSTV. I have one on order so cannot at the moment comment on it.

I hope this will be of interest to you and "G.G.". (B. G. G., Napier N.Z.).

● Thank you for your information, B.G.G., which we are sure will be of much interest to any of our readers interested in SSTV.

CASSETTE DECK: I have had some problems arising from the Playmaster 144 Cassette Deck (August and October 1974, File 1/RA/30,31).

Firstly, on playback when I advanced both the level controls to about halfway (trying to get meter indication on playback) the meters and the LEDs go into oscillation, accompanied by a type of buzz from the loudspeakers. The deck input and output are connected directly to the tape socket of a Playmaster 136. Could you please explain why it is unstable as I cannot see any sort of feedback circuit?

Also the two power supply capacitors seemed to be injecting noise. I changed capacitors and the only thing that changed was the tone. After a bit of advice from a friend and two 1uF capacitors, the noise was gone. Could you tell me the reason for this?

On page 39 of the October '74 the drawing of microphone sockets is wrong, unless your sockets are different from mine (which I doubt). As drawn, it shorted the microphone to earth.

● We will deal with your last query first as it has a bearing on your other queries. The microphone sockets must be the shorting type—they short the microphone input when not in use. If you use non-shorting sockets there will be a strong tendency for the recording amplifier to be unstable when used with high level sources, and this will be apparent by the meter and LED behaviour you describe.

The circuit will also be more sensitive to power supply ripple. You obtained a reduction in power supply noise because the 1uF capacitors you added are more efficient in filtering high-frequency components of the rectifier ripple.

PRINTED BOARDS: I would like to make a suggestion for a future article in your magazine. My suggestion is an article on how to design printed circuit boards—in particular boards for devices that contain 2 or more ICs. Although I have designed a couple of boards, they have left much to be desired in terms of compactness and neatness. (G.M., Roma, Qld.)

● Unfortunately, G.M., we are uncertain as to whether you are concerned with the actual mechanics of the artwork or with the design of the board itself. If you are concerned with the artwork mechanics, there are a number of commercial aids available, such as tapes, to make the job easier. If your query is on board design, we are afraid we are unable to be of much help. There are no hard and fast rules here; it is simply a matter of trial and error and experience.

6V CDI (November '71, 3/TI/10): I am about to build another 6V CDI system as published in your November 1971 issue. However on page 77, first column, third paragraph, it says 260 turns for the secondary winding of the inverter and yet in the second paragraph it says 230 turns. It also has 230 turns on the circuit. Which one is correct? Have there been any changes or mods to the circuit? (A. B., Rossmoyne, WA).

● The correct number of turns is as indicated on the circuit diagram, 230 turns. The only modification we would suggest is to omit the .001uF capacitor connected directly across the output of the converter. This was intended to dampen the spike from the transistors but in practice it seems to have little effect.

PHILIPS 60SR PRINTER: Would the Philips 60SR mosaic printer be suitable for reception of RTTY signals? I am sure that other SWLs would be interested in using it for this purpose, if you could describe it as a project. Incidentally you didn't mention the price of the printer in your article on connecting it to the EA microcomputer. Finally, what is a "panoramic adapter"? (G.P., Bunbury, W.A.)

● Because of its narrow paper format, its use of ASCII encoding and "line at a time" operation, the 60SR printer is not directly suitable for teleprinting work. However, it may be possible to adapt it for such use, and we intend looking into this shortly. As the printer costs around $500, it may not be as attractive to SWLs as you think, however. A panoramic adapter is a piece of equipment which connects to a communications receiver, and by means of swept-frequency techniques displays the amplitude of all incoming signals in the vicinity of the signal actually tuned. The display is usually on a cathode-ray tube, with frequency corresponding to the horizontal axis and signal amplitude the vertical axis. The vertical centreline is usually arranged to correspond to the signal frequency being received, so that the display shows any signal for say 200kHz either side.

CASSETTE DECK: I am now building the Playmaster stereo cassette deck and after studying the frequency response given (80Hz to 9kHz), I was wondering if it could be improved by the crossover technique as used for loudspeaker systems.

Perhaps an extra stage of amplification could come in at frequencies below 100Hz and this would not contain noise because it would cut out above 100Hz. For frequencies above 9kHz another extra stage would be required using some other method of cancelling noise. The above suggestions are only tentative at present but maybe some of your readers or staff could examine the possibilities. (R.B., Mount Claremont, WA).

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past 2 years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Only as available. Within last 6 months, face value. 7-12 months, add 5c surcharge; 13 months or older, add 10c surcharge. Post and packing for 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

INFORMATION CENTRE

• Your idea of improving cassette frequency response might be revolutionary were it not for the fact that only one tape head is used for record and replay, whereas loudspeaker systems generally use more than one loudspeaker to cover the spectrum. It is possible that a noise reduction system using dynamic filtering could be used to extend the useful bandwidth, however, and we plan to look into this shortly. Thanks for the comments.

BIONICS: For some time now, my colleagues and I have been interested in the fascinating hybrid science of bionics, the design and construction of automata based on biological examples. Unfortunately, source material on this new subject is very difficult to obtain, especially practical circuits of electronic animals. When material of this sort is available it usually comes from the U.K. in such magazines as Practical Electronics and Practical Wireless.

As Australia's foremost magazine on the subject of electronics, we were wondering if you would consider writing an article, or series of articles on bionics. We are sure that there would be many other interested readers, besides ourselves. (G. Mann, 9 Creekview Close, Rossmoyne WA 6155).

• Although the subject of bionics is relatively unknown to us, we have had correspondence from some readers in your home state (Information centre, May 1975). For this reason, we have taken the liberty of printing your full name and address, so that interested readers will be able to contact you and your colleagues directly. As this is a fairly specialised subject, we have no plans at the present time to present any articles on bionics, but will keep the idea in mind.

TRAIN CONTROLLER: I have built and used the SCR-PUT train controller described in "Electronics Australia" April 1971 (File 2/MC/9) with great success

on HO train circuits but I have not had the same experience with a similar controller built for an "N" gauge system. I have used a Motorola 2N4443 SCR but otherwise the circuit is as specified. Voltages are okay but the train operates slowly and throttle has no effect.

I have come to two possible conclusions as to the cause of my problems; one that the SCR operating voltage is higher than that for the C20D, or "N" gauge trains have a different EMF effect to that for which the circuit is designed. (L. D., Auckland, NZ).

• Our conclusions from your letter (which we have condensed), is that the FET is faulty or the 3.9k resistor has been inadvertently replaced with a low value. The different SCR should cause no problems.

CASSETTE TAPE: In the February '75 issue of "Electronics Australia" is a review of the Sony TC177 cassette deck.

To date I have been a reel-to-reel man and presently operate a Revox A77 with which I am very happy. I will shortly be acquiring a Sony TC137 which seems electronically similar to the Sony TC177. This brings me to the point of this letter which is the difficulty, apart from lengthy comparisons, of deciding which brand of cassette tape to use. Leaving aside the complication of Ferrichrome, the point is to choose between chromium dioxide and ferric tape.

Why, for example, did you use TDK ED and BASF tape for the TC177 and not Sony tape? Is there any real difference? The price difference of nearly twice seems to mitigate against chrome, particularly if the ferric is smooth and flat to say 12kHz.

I would appreciate any views or data you have which is relevant to this problem and particularly to the Sony TC137, if you have examined it. (E. B., Wollongong, NSW).

• To answer your first question, the tapes we used for testing the TC177 were those on hand and they can be expected to be very similar to Sony ferric or chromium dioxide. You are right in suggesting that there is little advantage with chromium dioxide in view of the price differential. We have little extra data on the subject which would alter your present view.

ERRATUM

PLAYMASTER 146 AM-FM TUNER (September, 1975, File No. 2/TU/44). Add to the parts list 1 transformer, 240V primary 12.5V 150mA secondary, Ferguson PF2851, A & R 6474, or similar. The 470 ohm decoupling resistor to the second 9187 IF transformer is shown in error as 4.7k on the PC board wiring diagram.

FORUM continued from page 63

Are the stockists themselves beyond criticism? I think not. If they decide privately that a particular project won't take on (and this is part of the judgement they have to exercise) they may not even order the key components until there is a line of customers pounding on the counter. Or they may order conservatively, or advertise prematurely, with much the same result.

If we had another page to spare, we could tell quite a story about situations where we've been caught out, other journals have been caught out, suppliers have been mistaken or mislead, or where stockists have misjudged their own market. We might even be able to suggest (in hushed tones) that the Dick Smith organisation is subject to the same human frailties as the rest of us!

But the point is taken and we're willing to make a bargain: We'll do the best we can in the future if suppliers (including Dick Smith) will do the best he (or they) can!

Q-METER PROJECT continued from page 73

should now be excellent and the output to the Q-meter is thereafter adjusted only by the Output control R1. The process should be repeated when switching to other frequency ranges.

To measure the Q of a coil, connect it to the "L" terminals, switch the voltmeter to "V" and adjust the oscillator output to give 1 volt exactly at the frequency of measurement. Switch the voltmeter to "Q", tune C2 to resonance and read the Q on the voltmeter scale in terms of indicated voltage X100.

A good earth connection will probably be needed and this should be to an Earth terminal on the Q-meter, located near C2 and connected to it by a short copper-braid pigtail.

The effective Q of other components such as fixed capacitors can also be measured and calculated by appropriate formulae, but these are perhaps outside the scope of this article. They can be found discussed in any good general textbook, such as Terman's "Electronic Engineer's Handbook". For such work, standard coils of known high Q and appropriate inductance for the frequency or measurement will be needed as accessories. They can be constructed without trouble by using ferrite pot cores mounted on suitable plug-in bases and preferably wound with Litz wire.

The oscillator draws a current of around 3.5 mA from the 9-volt battery with the specified transistors. Drain from the 1.5 volt cell is in microamps and negligible. Should output voltage on the highest frequency range be found inadequate for any reason the supply voltage can be increased safely to 12 or 15 volts.

The MOSFETs come equipped with a tiny shorting spring around their leads to protect against accidental gate insulation breakdown, and these are best left in place until all soldering has been completed.

REFERENCES

(1) P. J. Baxandall: "The Fundamental Principles of Transistor Circuits. Lecture 4. Transistor Sine-Wave Oscillators". Royal Radar Establishment Journal, No. 45, October 1960.

(2) J. Luijckx: Letter, "Circuit Magnification Measurements". Electronic Engineering, June 1957, page 298.

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4GY

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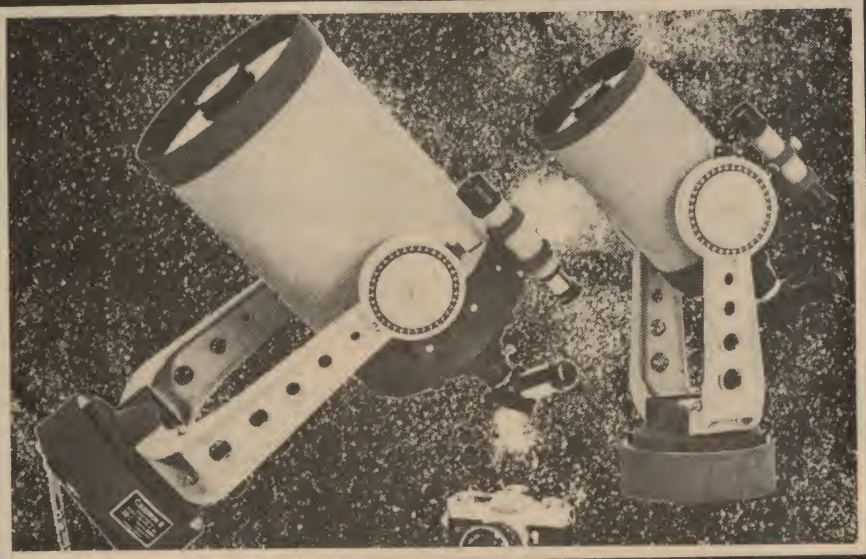

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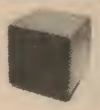

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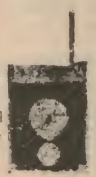

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